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(12) **United States Patent**
Kira et al.

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(45) **Date of Patent:** ***Oct. 25, 2016**

(54) **INFORMATION PROCESSING APPARATUS,
STORAGE MEDIUM, INFORMATION
PROCESSING METHOD AND
INFORMATION PROCESSING SYSTEM FOR
PRESENTING IMAGE CANDIDATES
HAVING SIMILARITY TO AN IMAGED
IMAGE**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 590 days.

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Primary Examiner — Mehrdad Dastouri

(22) Filed: **Aug. 8, 2011**

Assistant Examiner — Joseph Becker

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G06K 9/46 (2006.01)

(Continued)

(52) **U.S. Cl.**

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(2013.01); **H04N 13/0242** (2013.01); **H04N**
2013/0074 (2013.01)

(58) **Field of Classification Search**

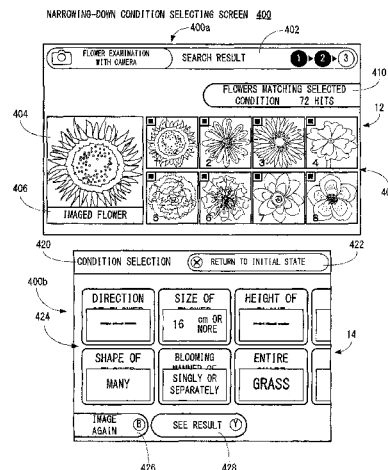
CPC G06F 3/00; H04N 13/02; H04N 2013/0074;
G06K 9/48; G06K 9/4652

See application file for complete search history.

(57) **ABSTRACT**

A game apparatus includes a CPU, and in a mode of examining a flower based on an imaged image, the CPU activates two outward cameras to allow a user to image a flower. The CPU obtains color information, shape information and a size of the imaged flower from the imaged image. A shape category is obtained from the shape information, and with the shape category, data for search included in a database for search is filtered. Then, by comparing color information, shape information, and the size of the imaged flower with the data for search to be used, a score of a degree of approximation of the color information and scores of the degree of matching of the shape information and size, etc. are obtained. Then, images of flowers as candidates are presented in the descending order of the score (similarity level).

7 Claims, 29 Drawing Sheets



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FIG. 1

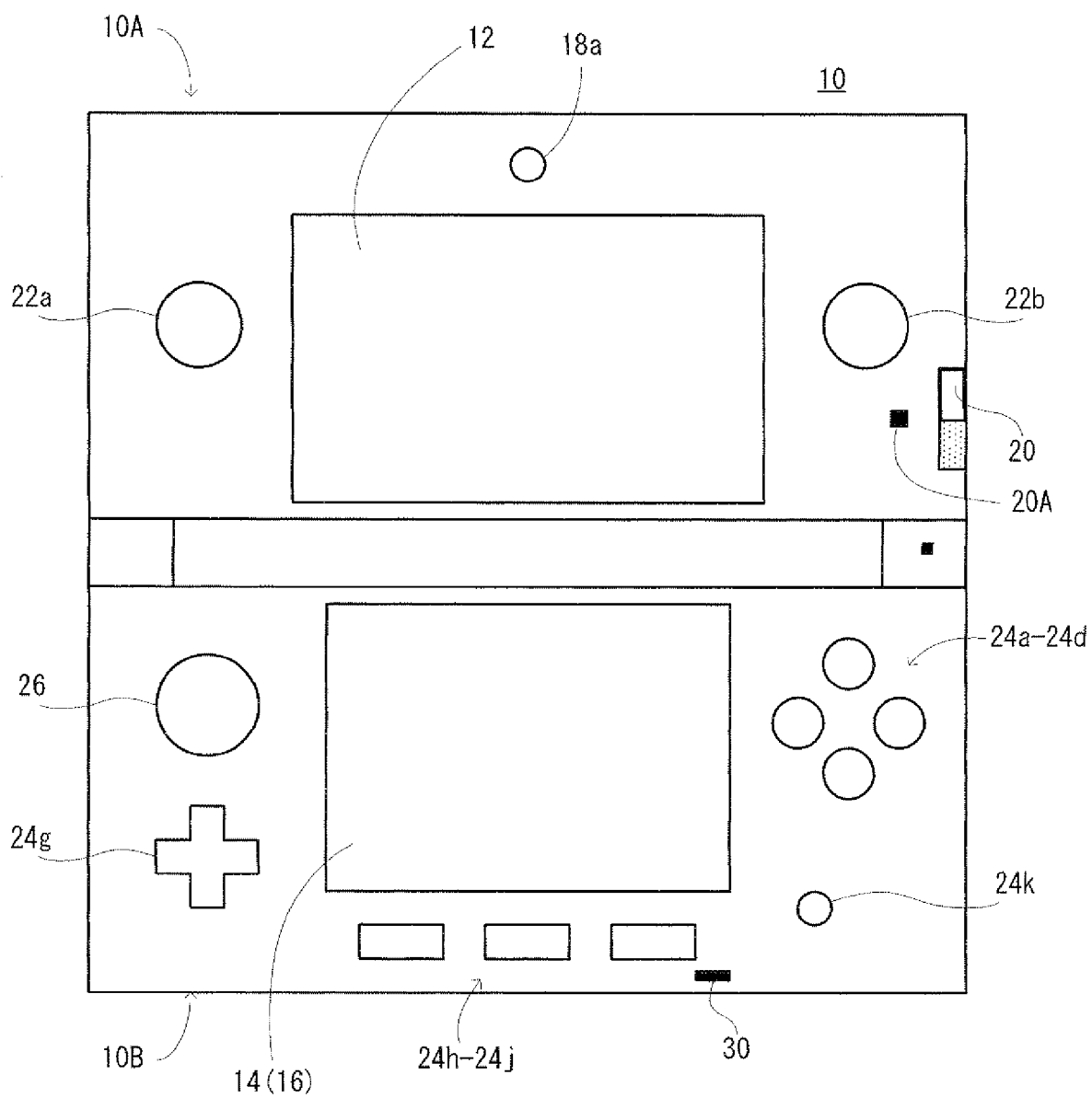


FIG. 2

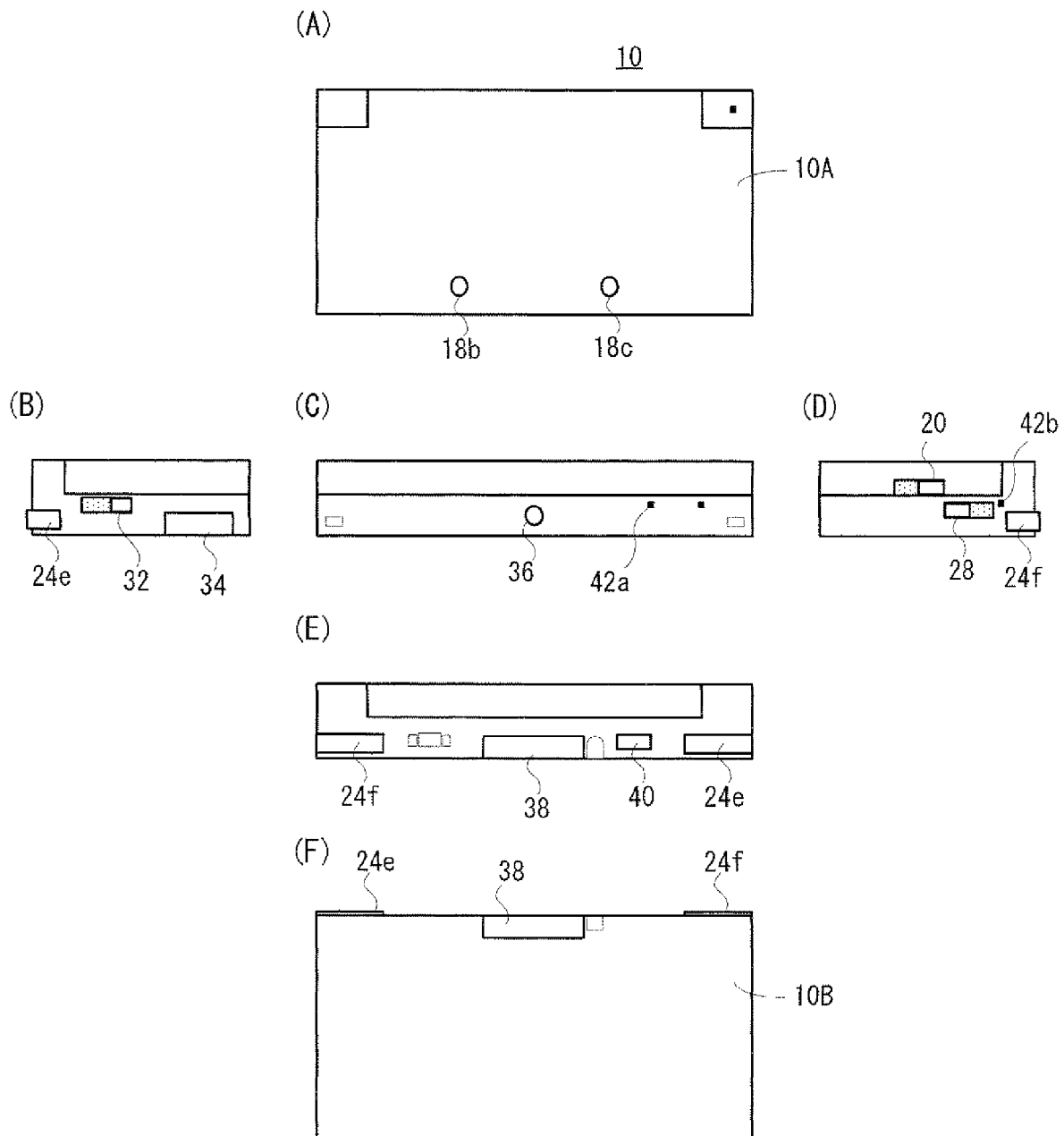


FIG. 3

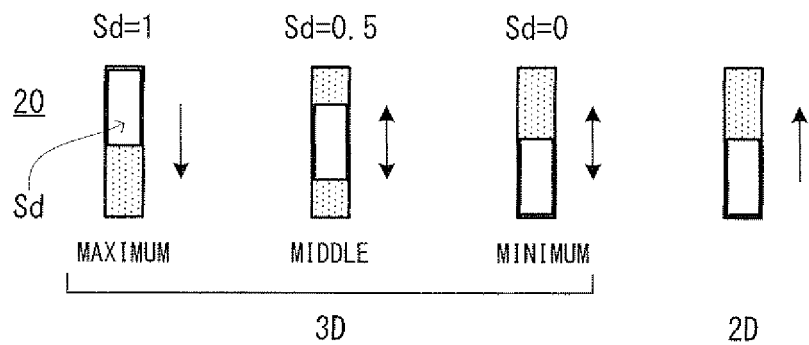


FIG. 4

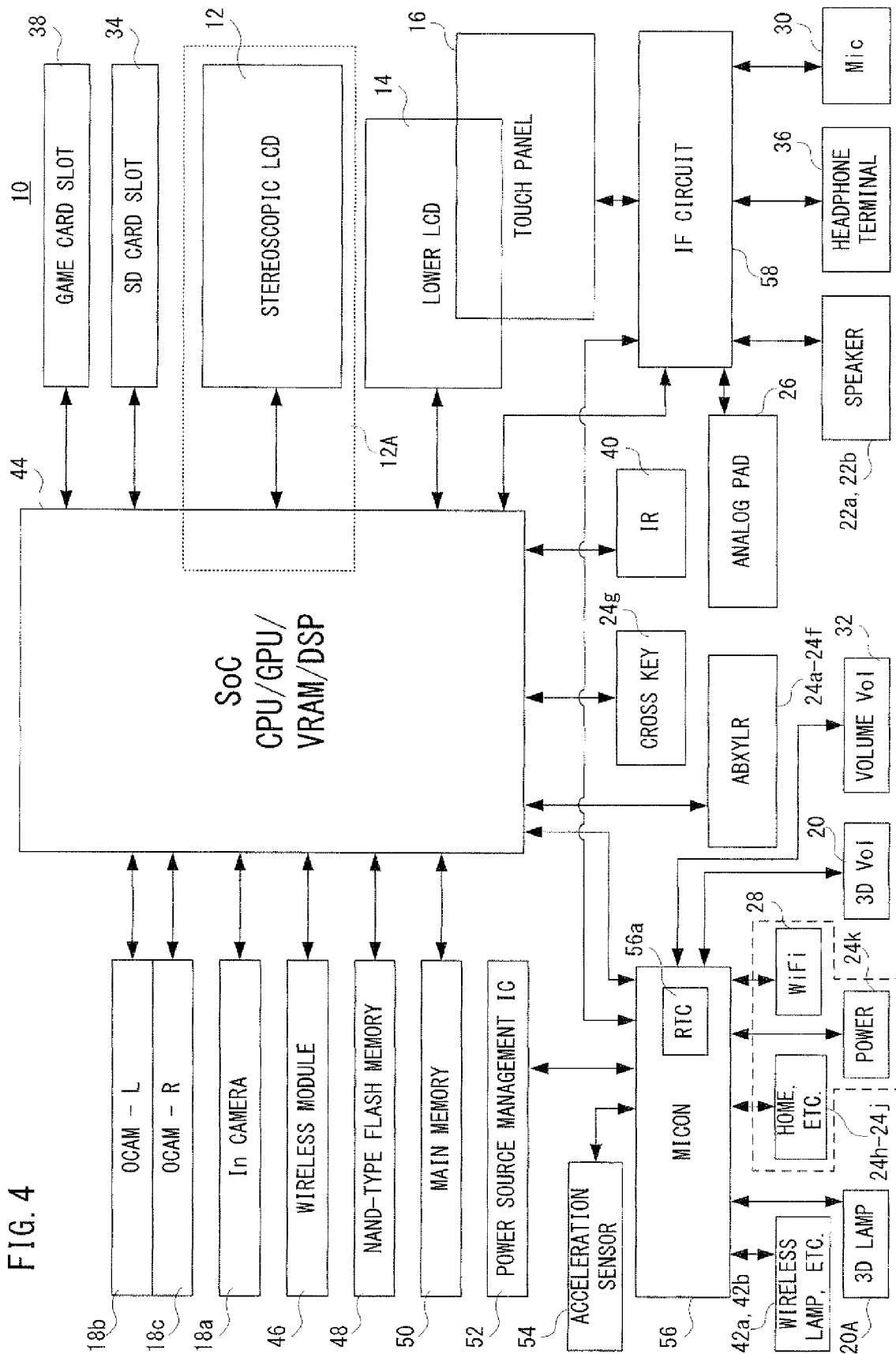


FIG. 5

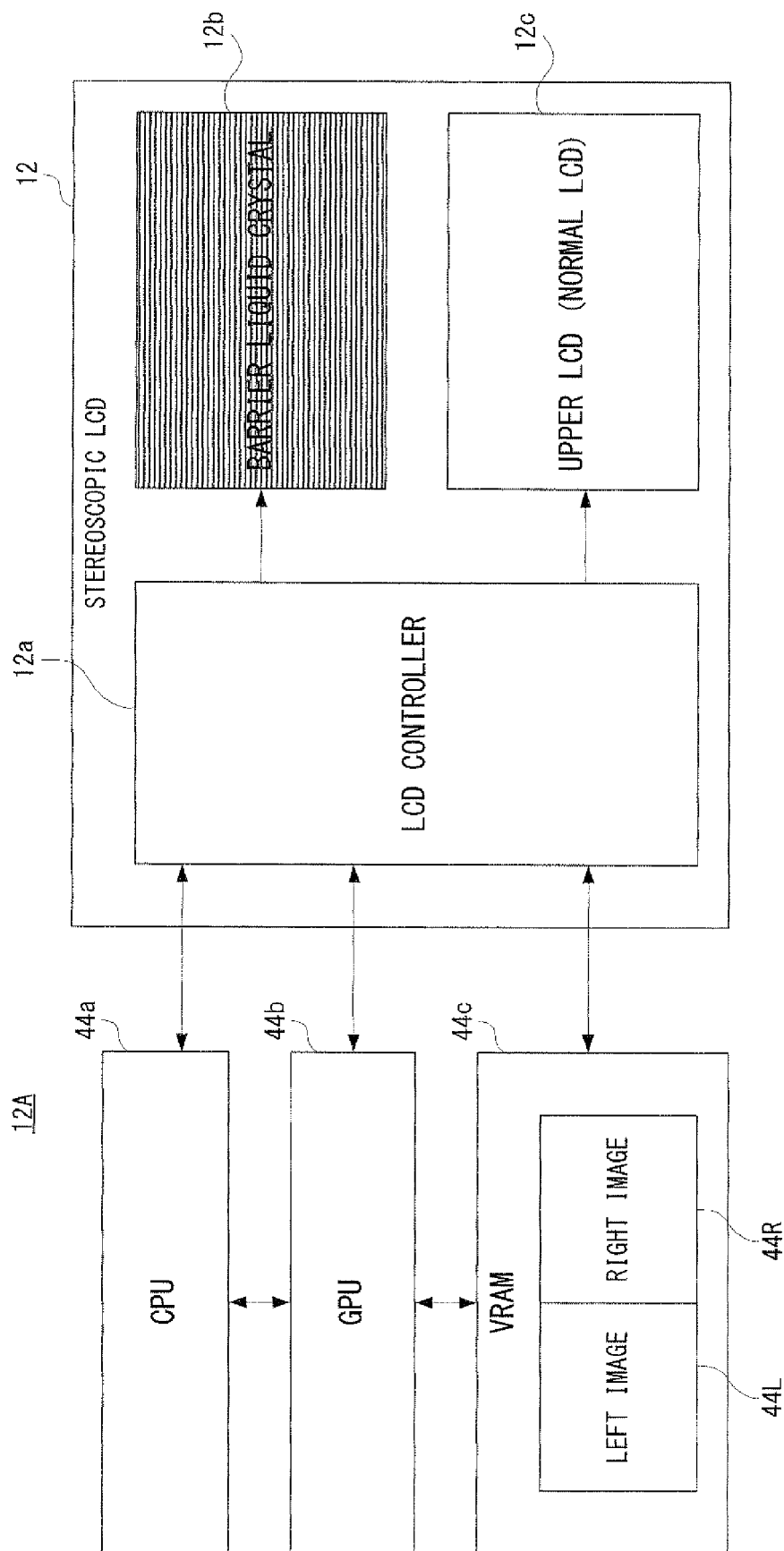
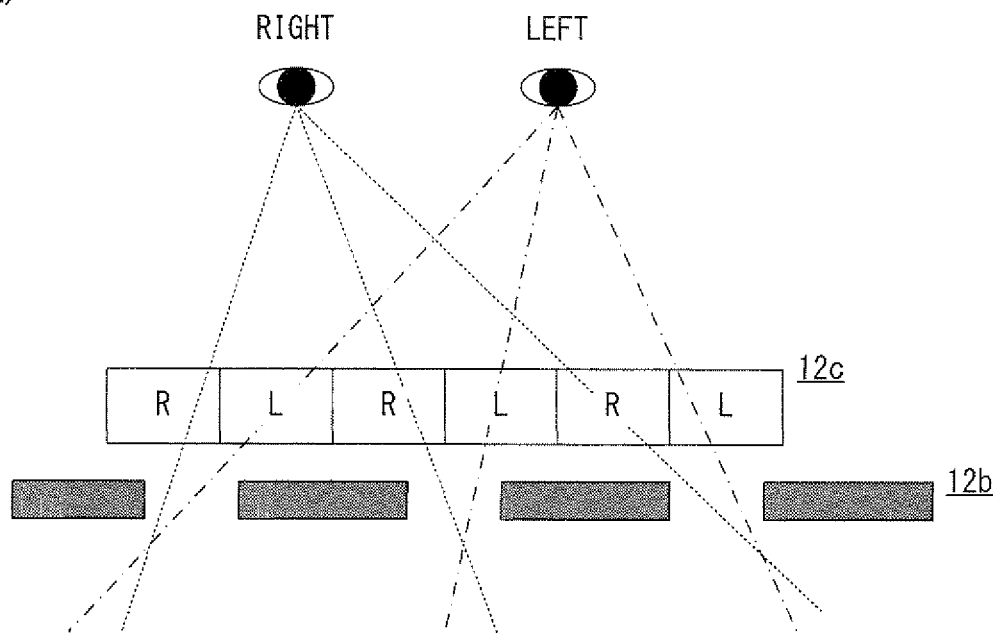


FIG. 6

(A)



(B)

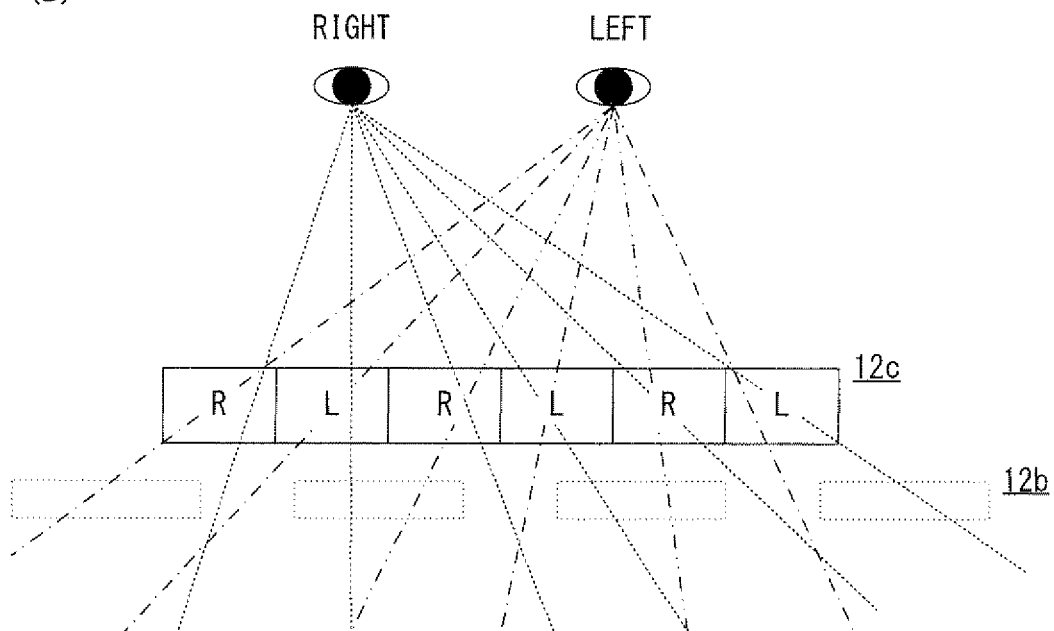


FIG. 7

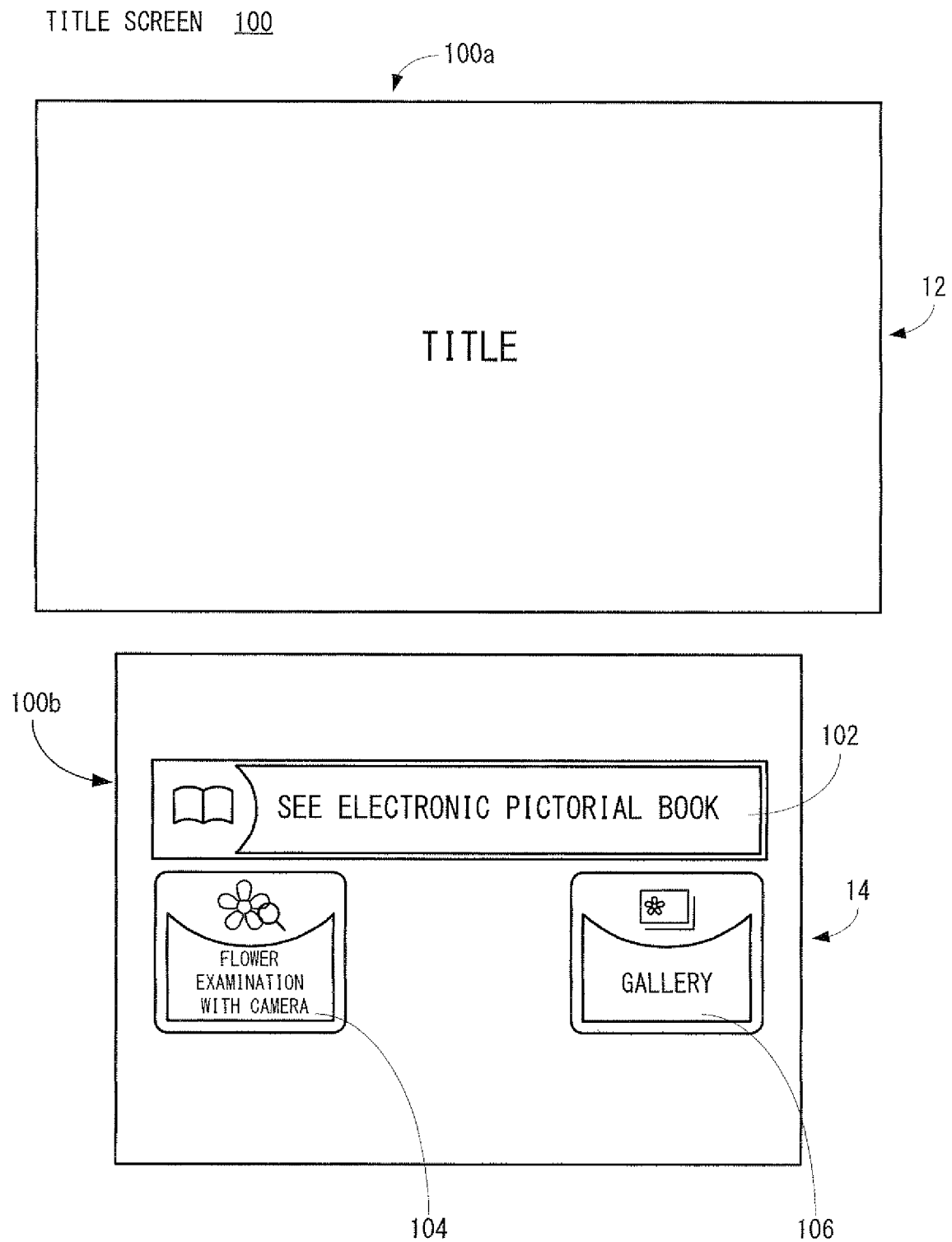


FIG. 8

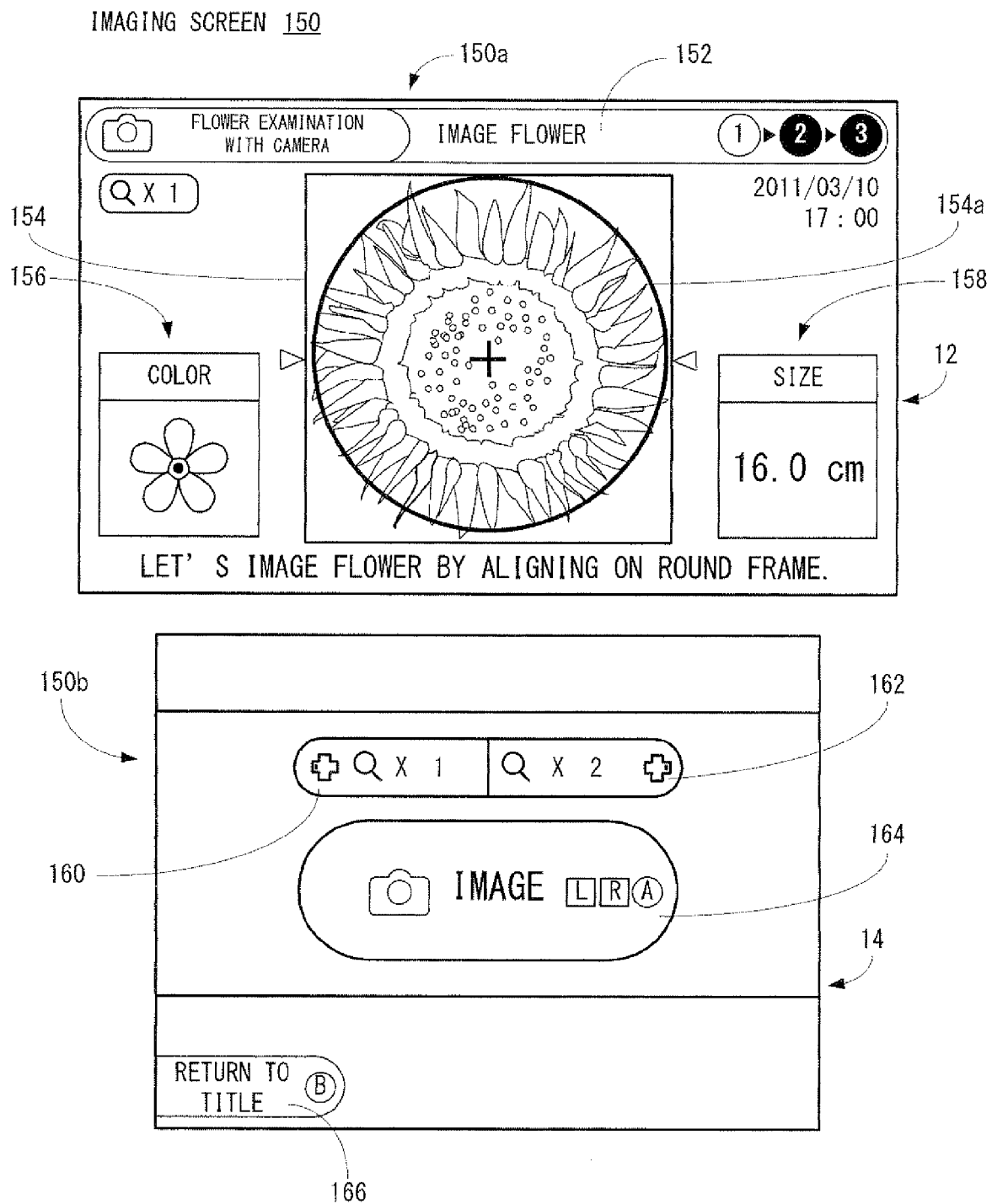


FIG. 9

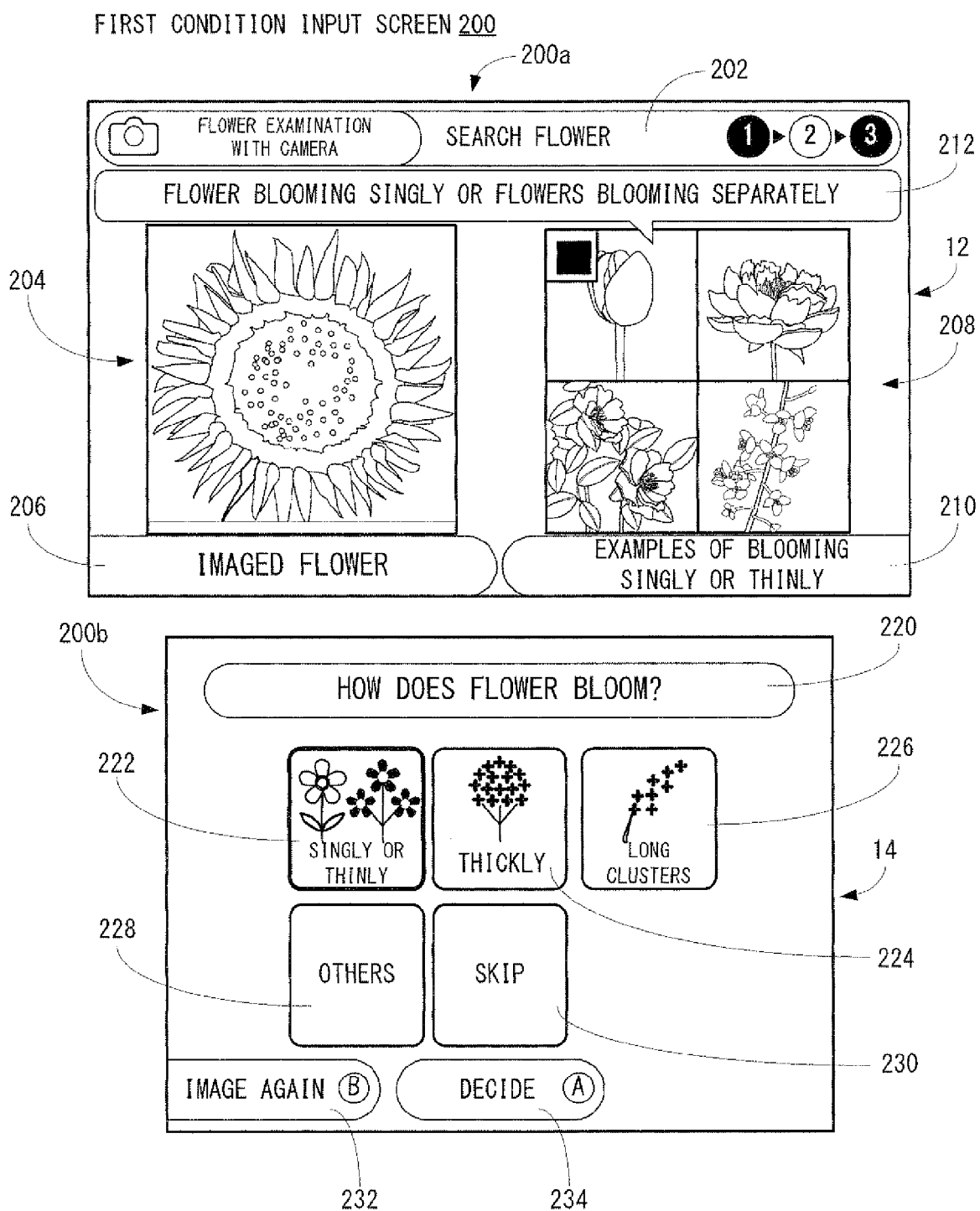


FIG. 10

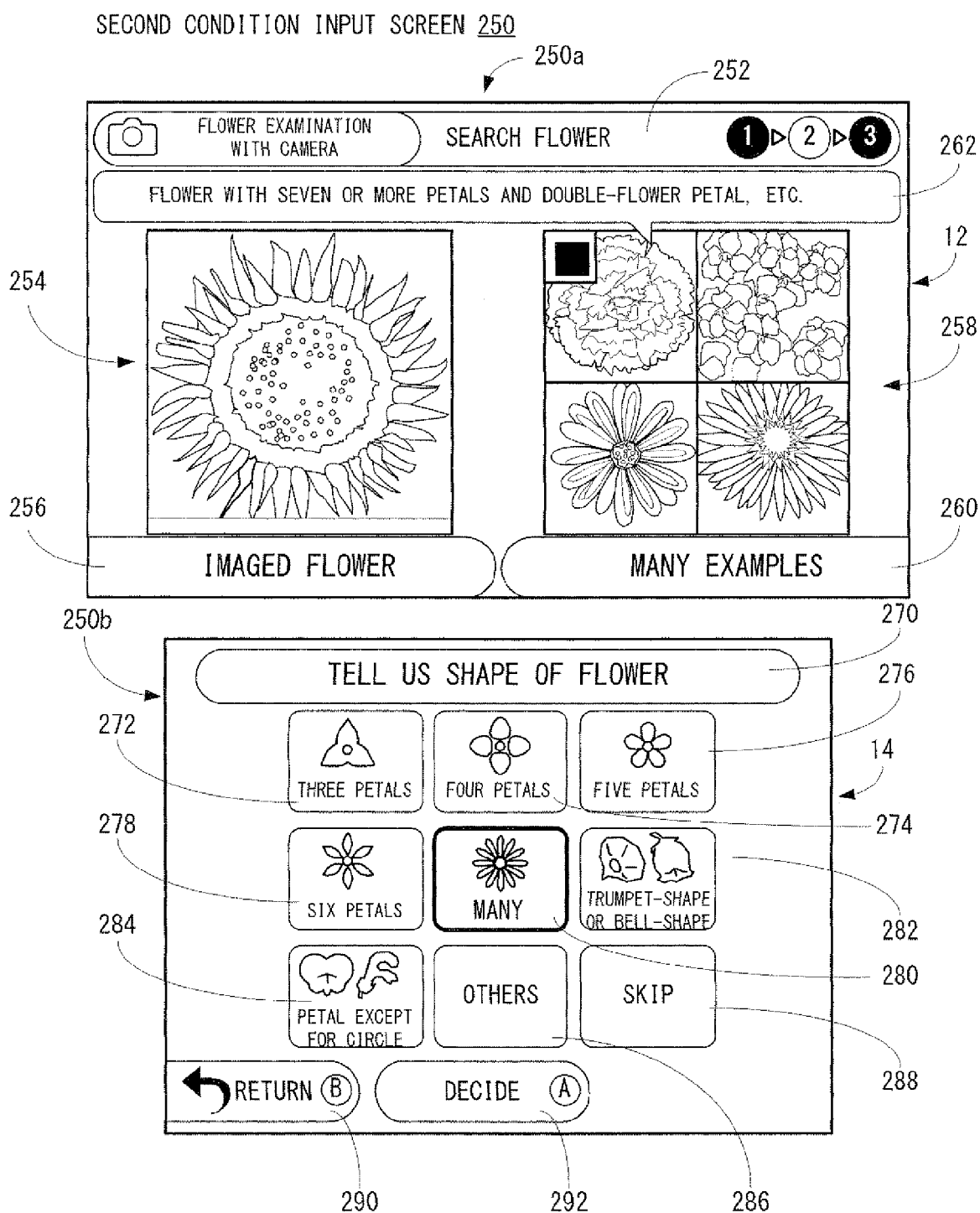


FIG. 11

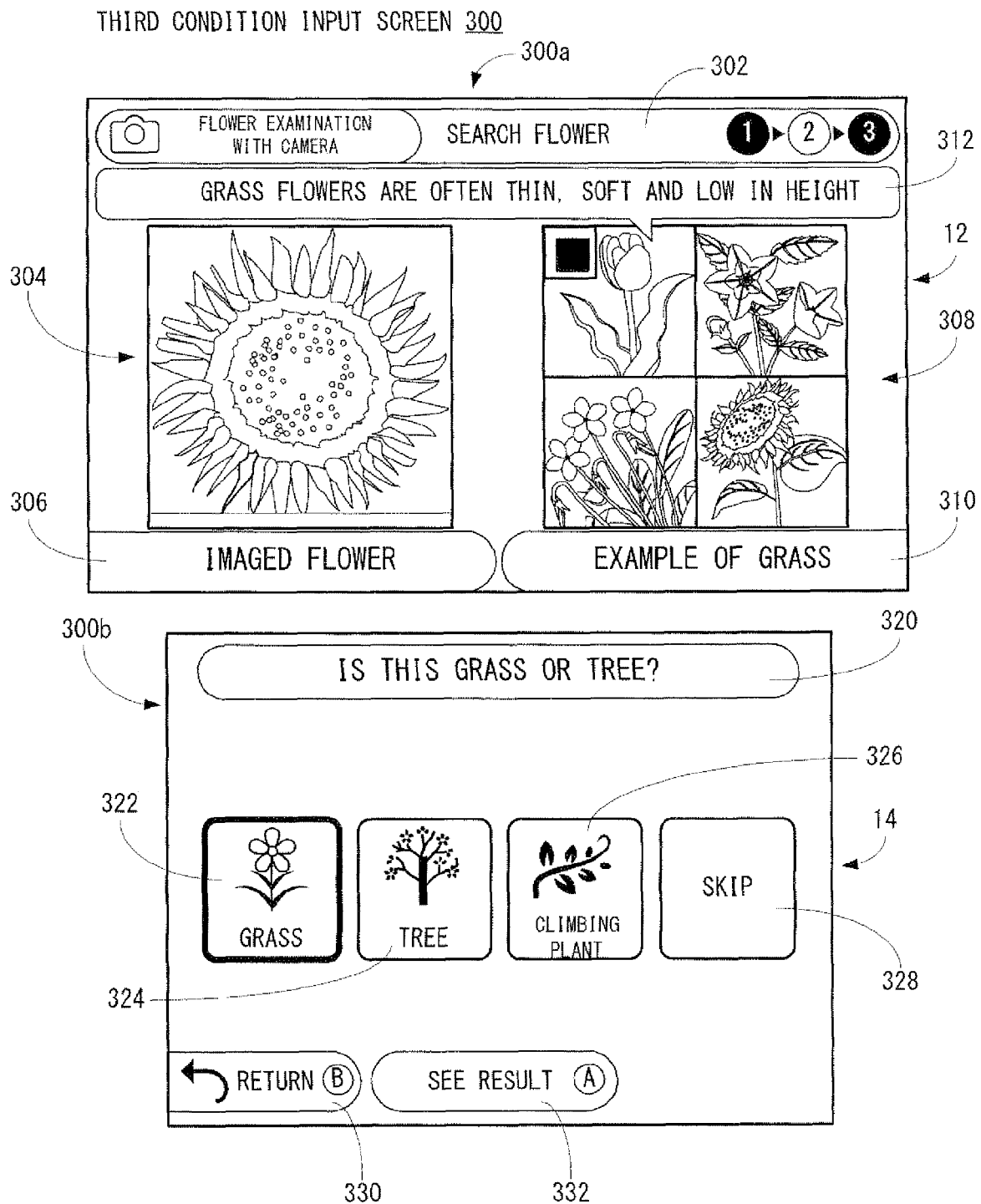


FIG. 12

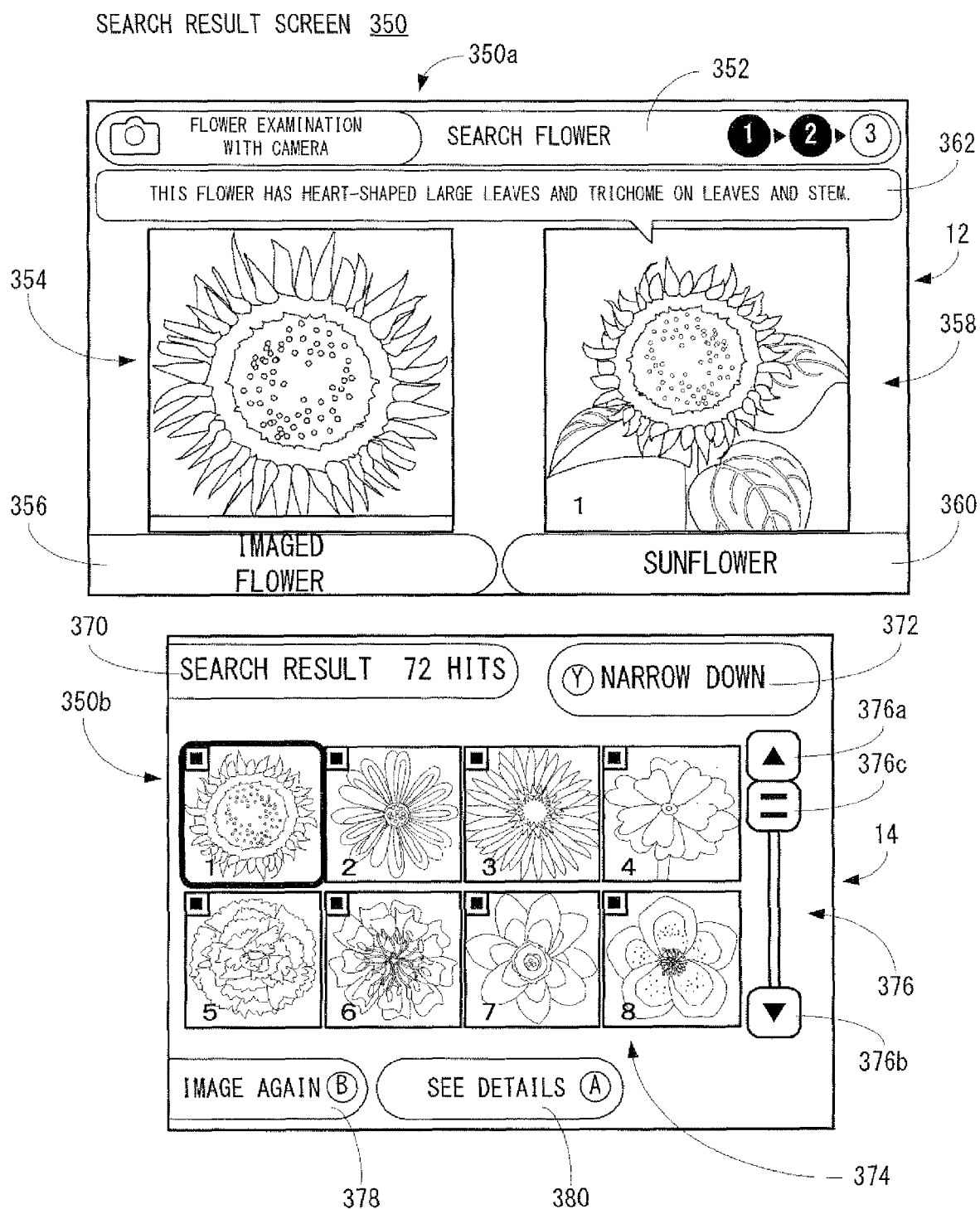


FIG. 13

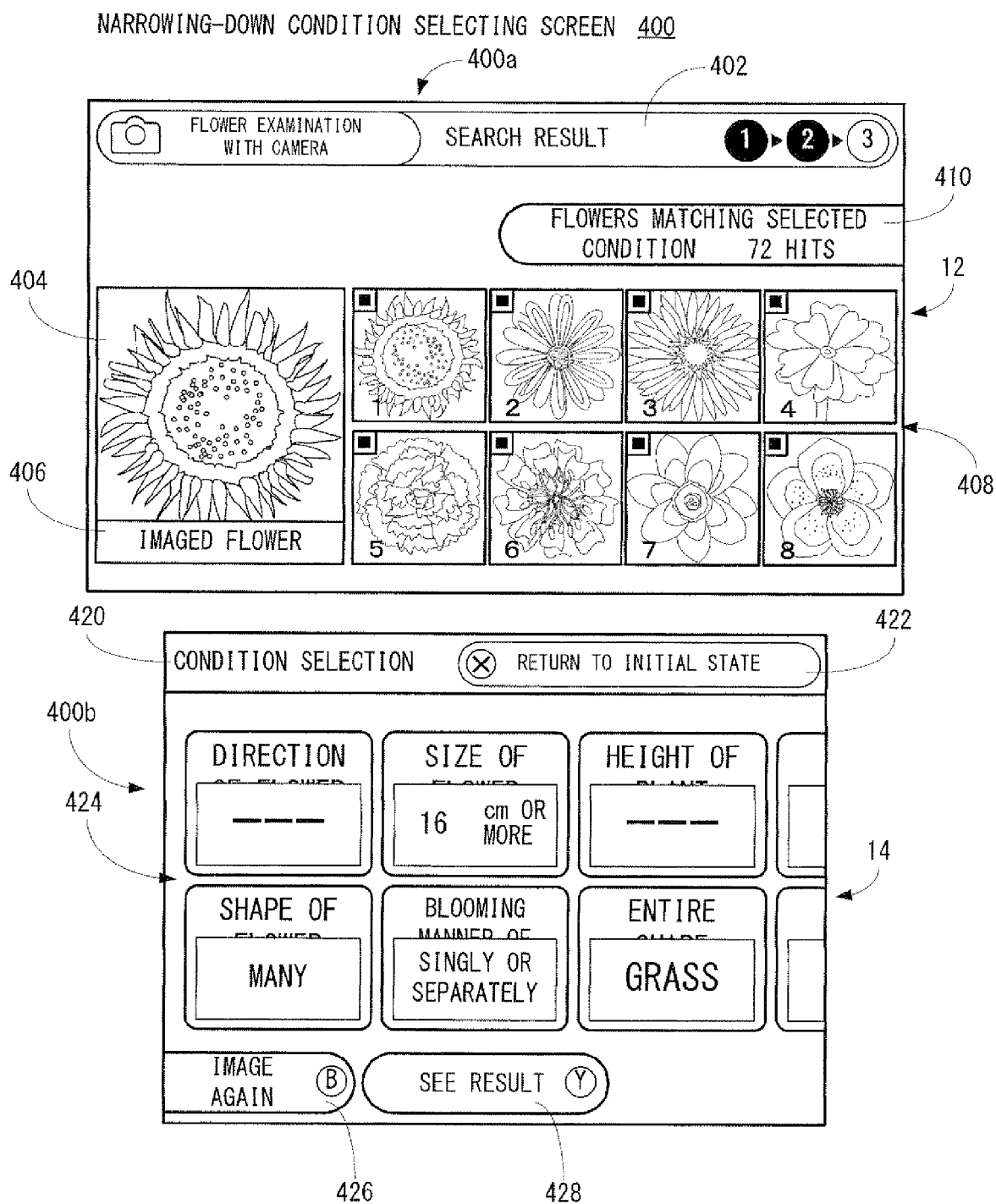


FIG. 14

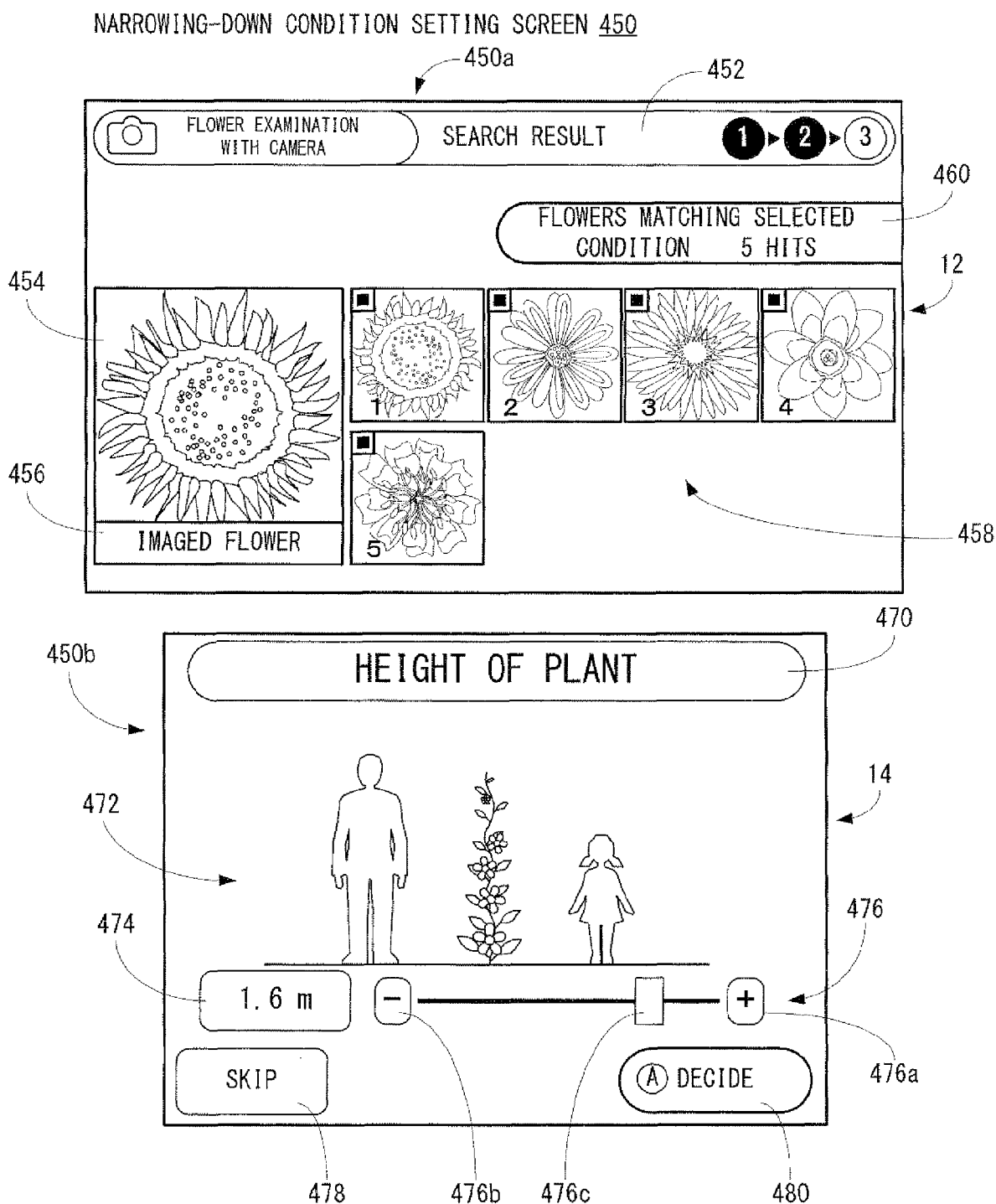


FIG. 15

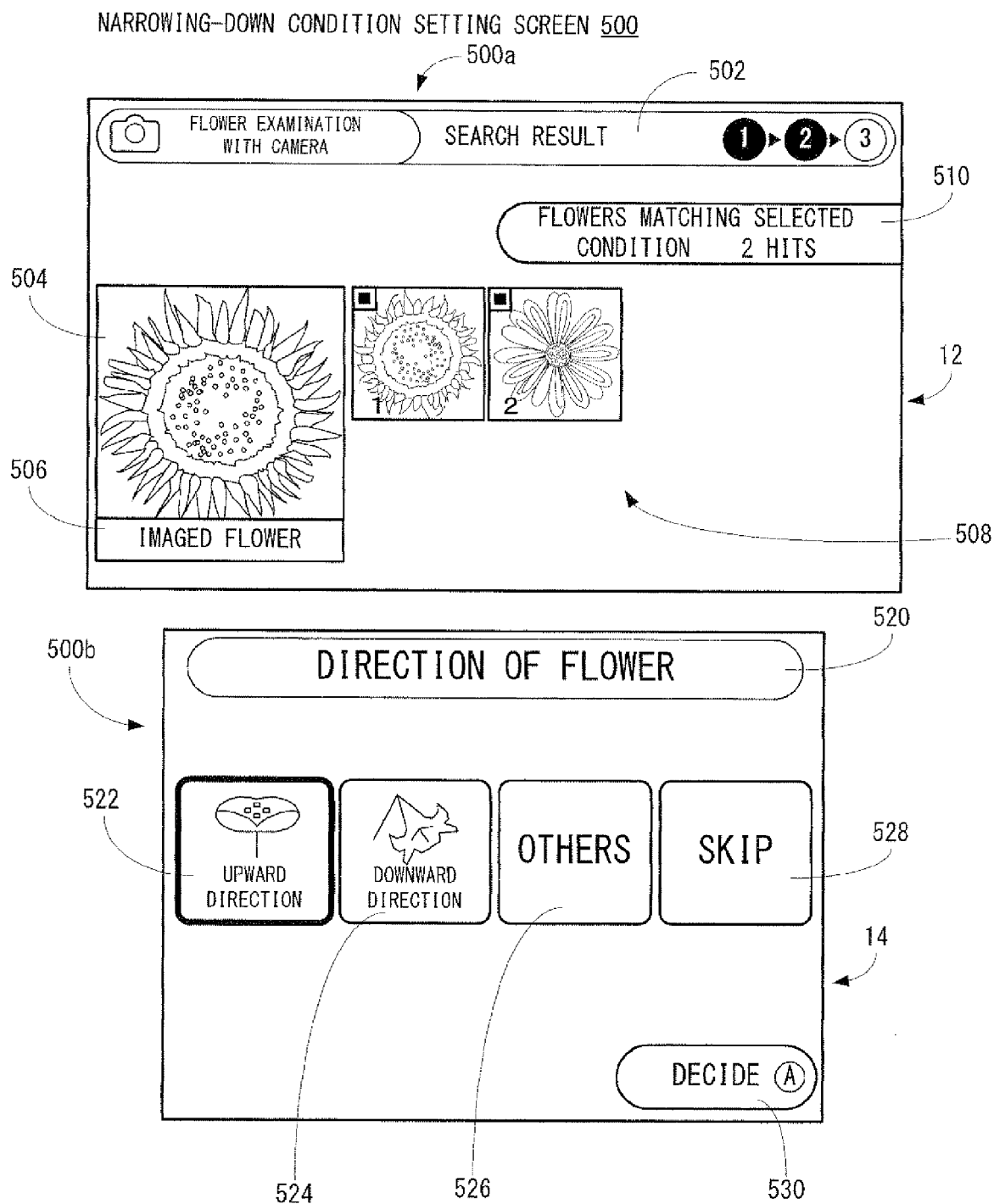


FIG. 16

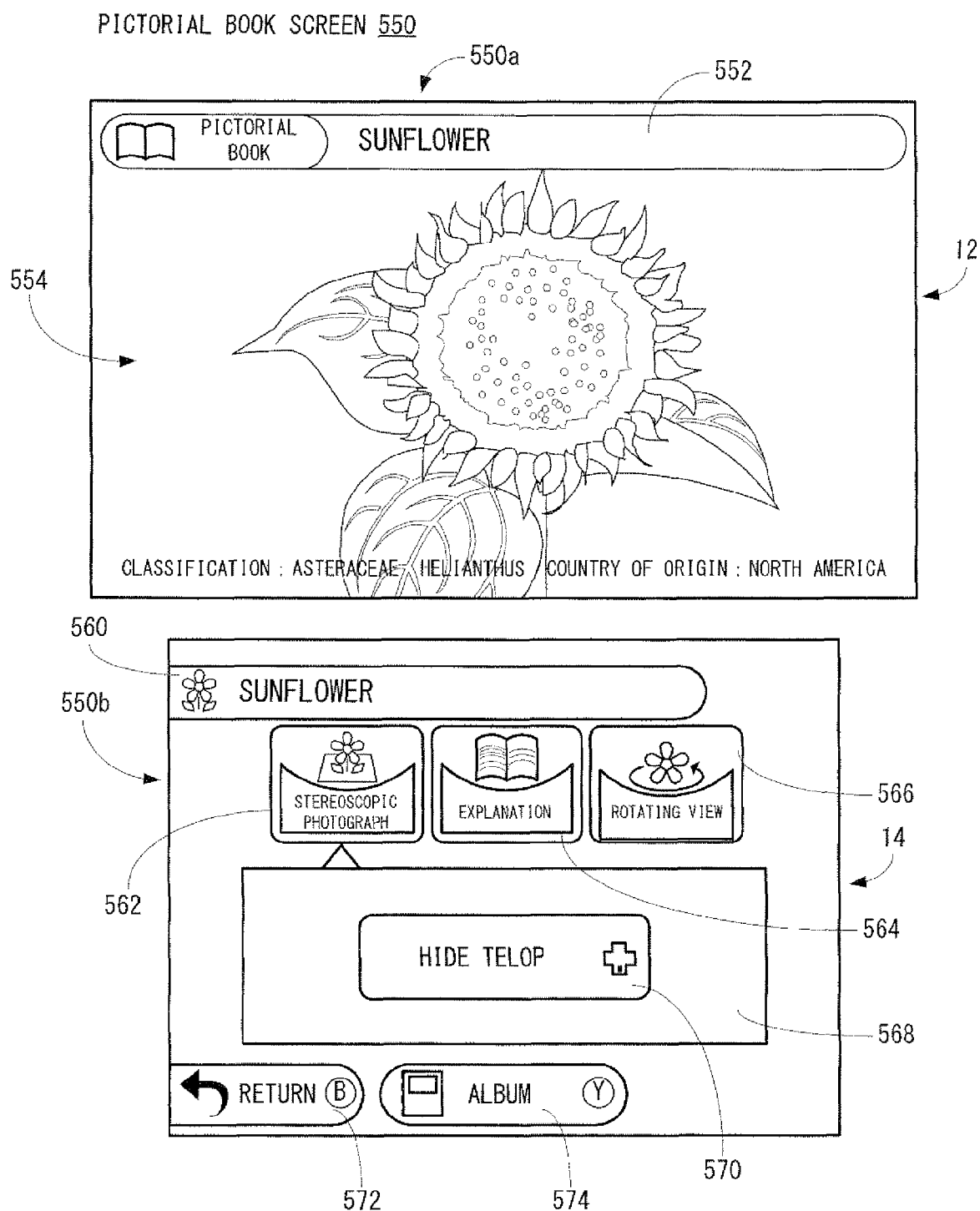


FIG. 17

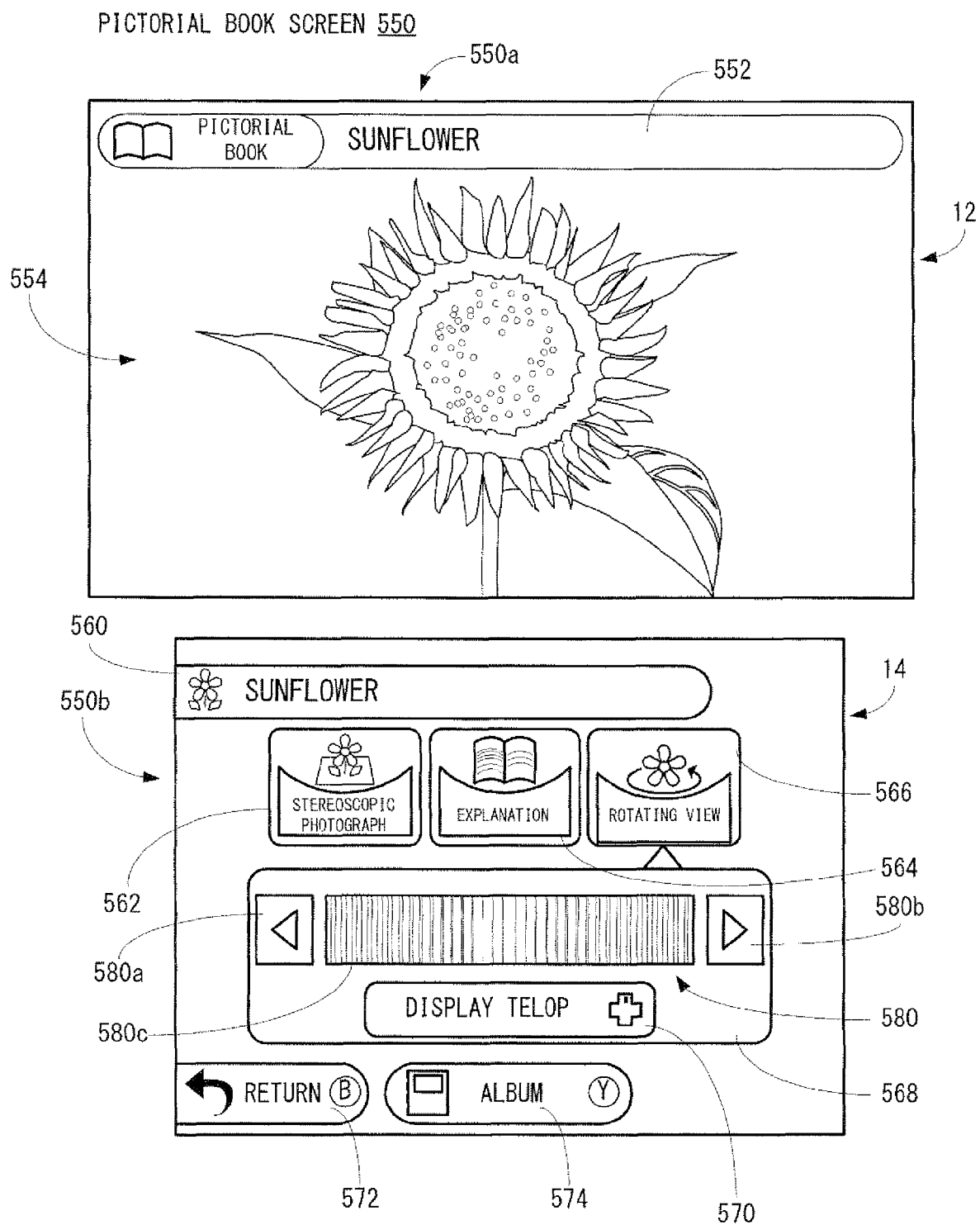


FIG. 18

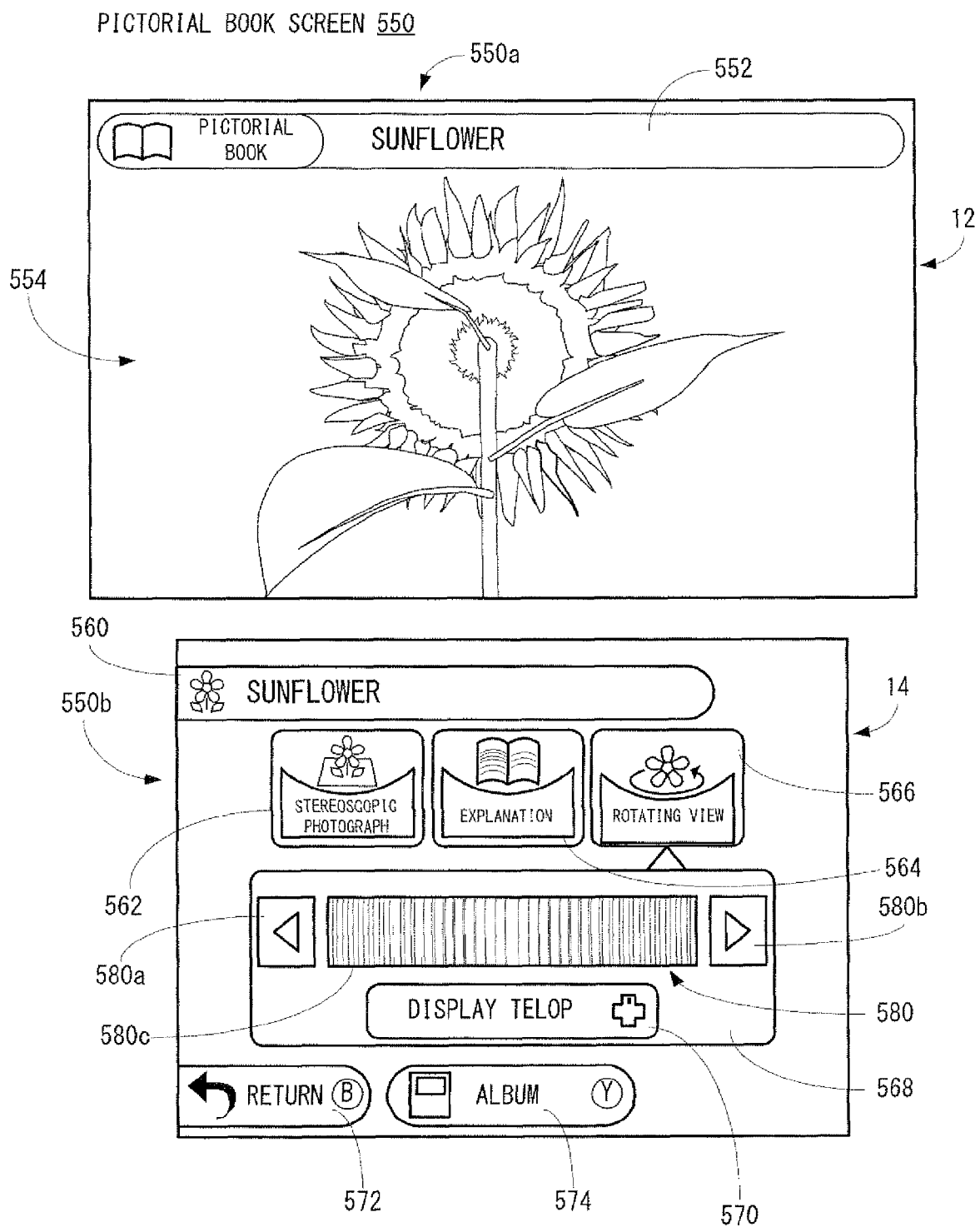


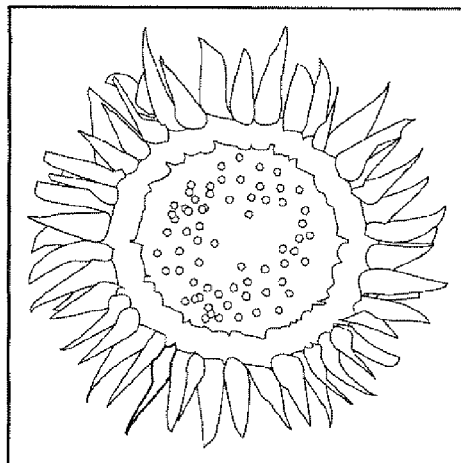
FIG. 19

OVERVIEW OF DATA FOR SEARCH

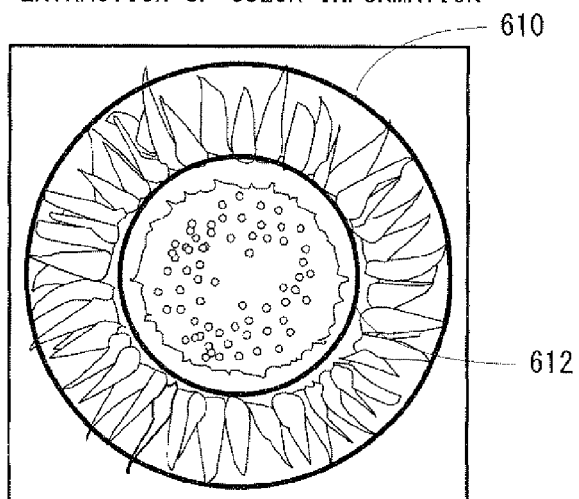
ID	
NAME OF FLOWER	CONDITION INFORMATION
COLOR INFORMATION	SIZE OF FLOWER
HISTOGRAM	TIME OF BLOOM
SHAPE INFORMATION	DEGREE OF ENCOUNTER
THE NUMBER OF SHORT PETALS	HOW FLOWERS BLOOM
THE NUMBER OF LONG PETALS	SHAPE OF FLOWER
PERIPHERAL LENGTH OF FLOWER	KIND
AREA OF FLOWER	DIRECTION OF FLOWER
COMPLEXITY OF SHAPE OF FLOWER	HEIGHT OF PLANT
WIDTH OF RECTANGLE CIRCUMSCRIBED ABOUT OUTLINE OF FLOWER	⋮
HEIGHT OF RECTANGLE CIRCUMSCRIBED ABOUT OUTLINE OF FLOWER	IMAGE INFORMATION
SHAPE CATEGORY	REDUCED IMAGE
JUDGMENT FLAG	

FIG. 20

(A) CUT-OUT IMAGE 600



(B) EXTRACTION OF COLOR INFORMATION



(C) EXTRACTION OF COLOR INFORMATION

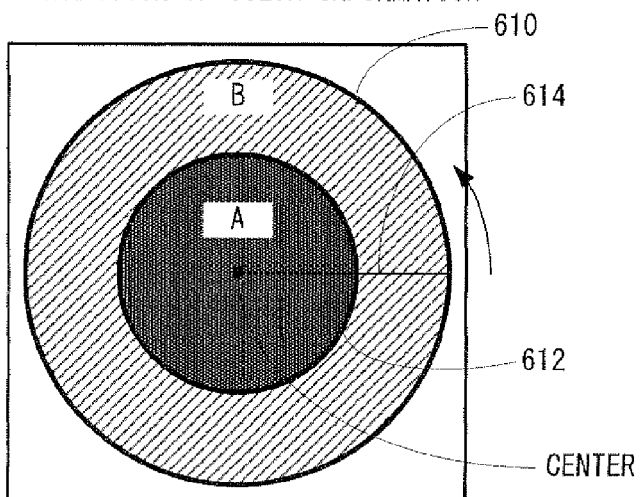
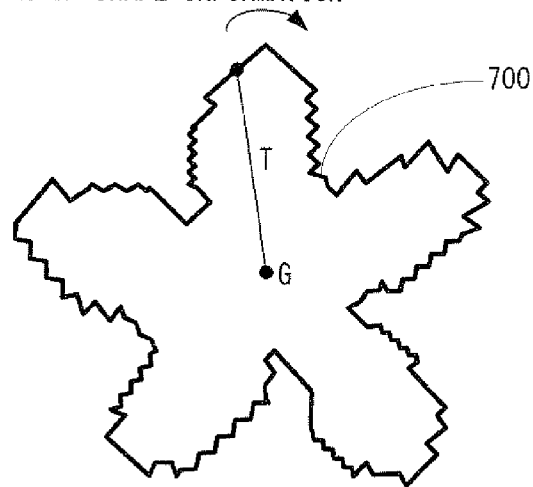
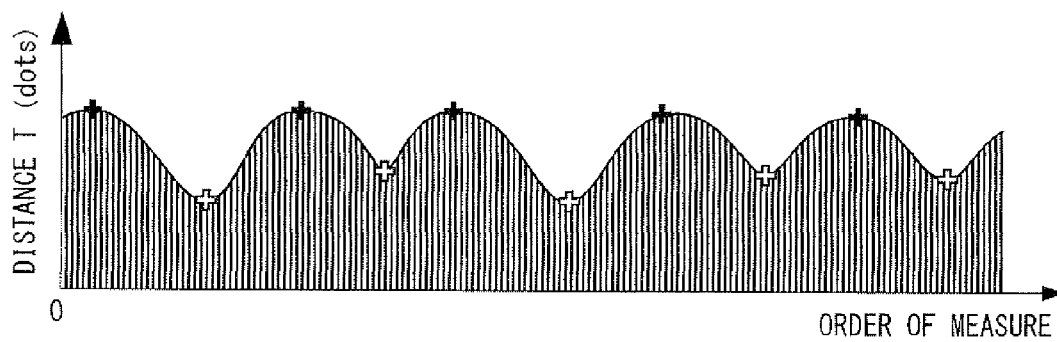


FIG. 21

(A) EXTRACTION OF SHAPE INFORMATION



(B) SHAPE GRAPH



(C) RECTANGLE CIRCUMSCRIBED ABOUT OUTLINE OF FLOWER 710

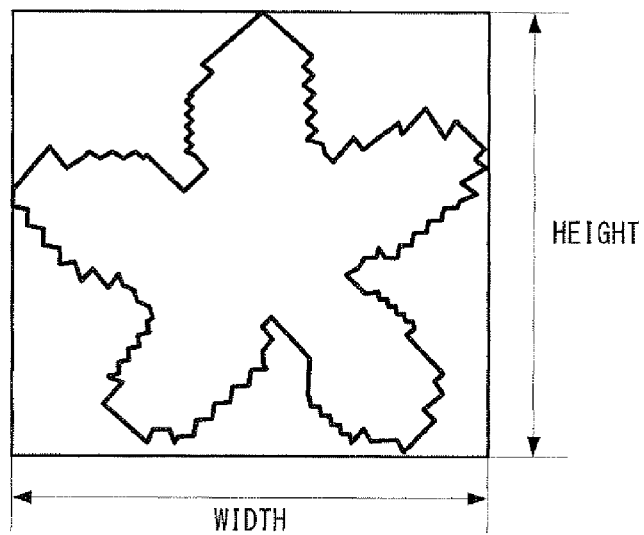


FIG. 22

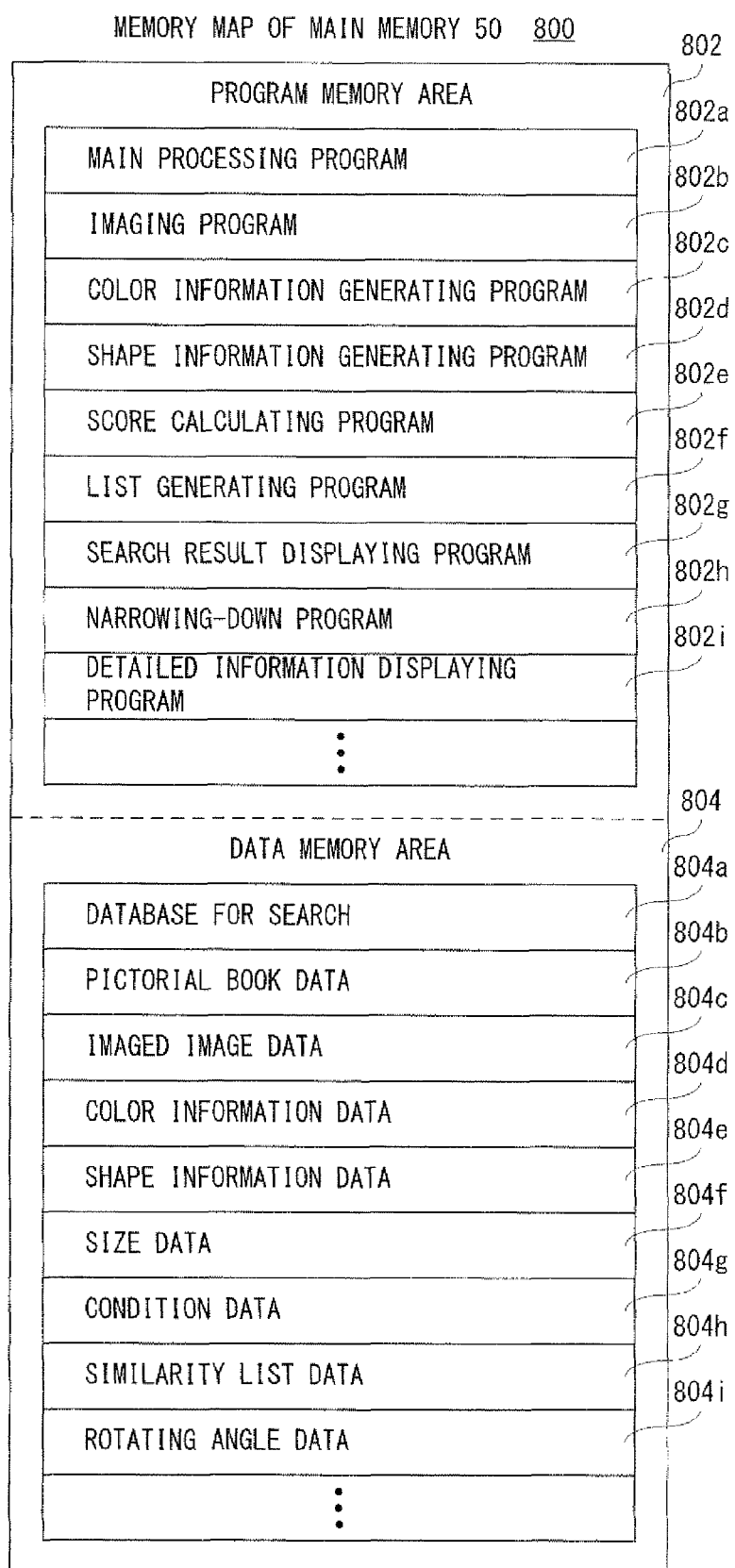


FIG. 23

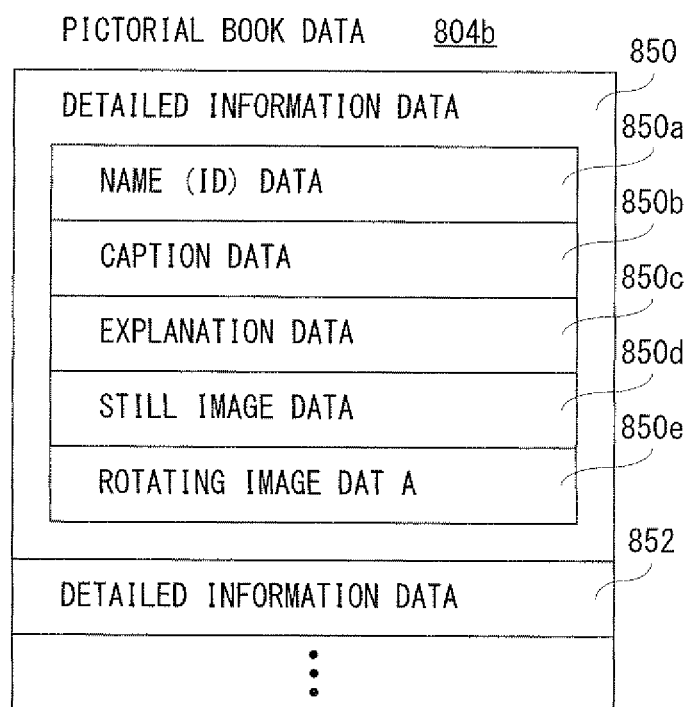


FIG. 24

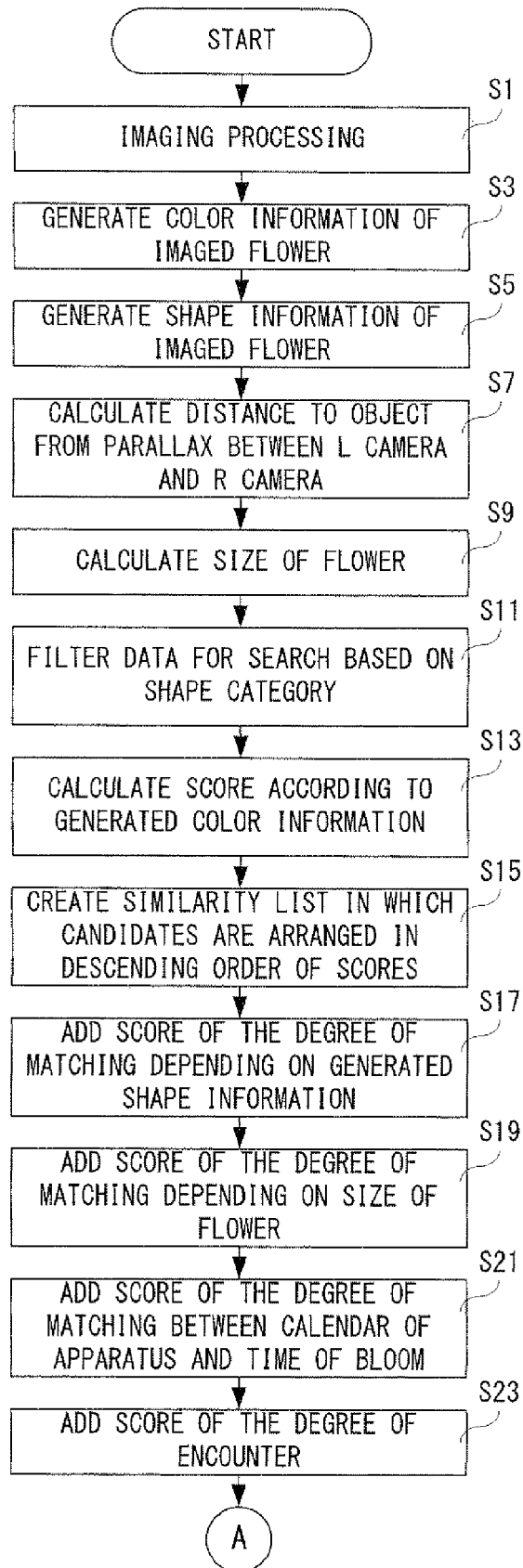


FIG. 25

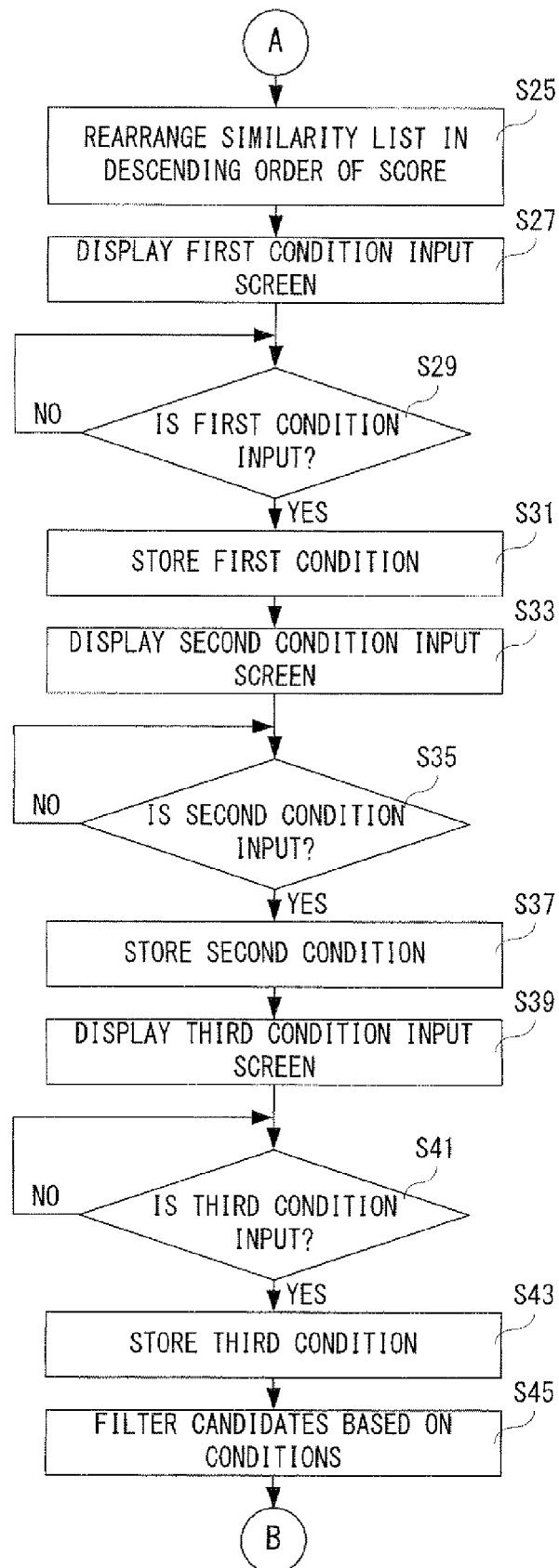


FIG. 26

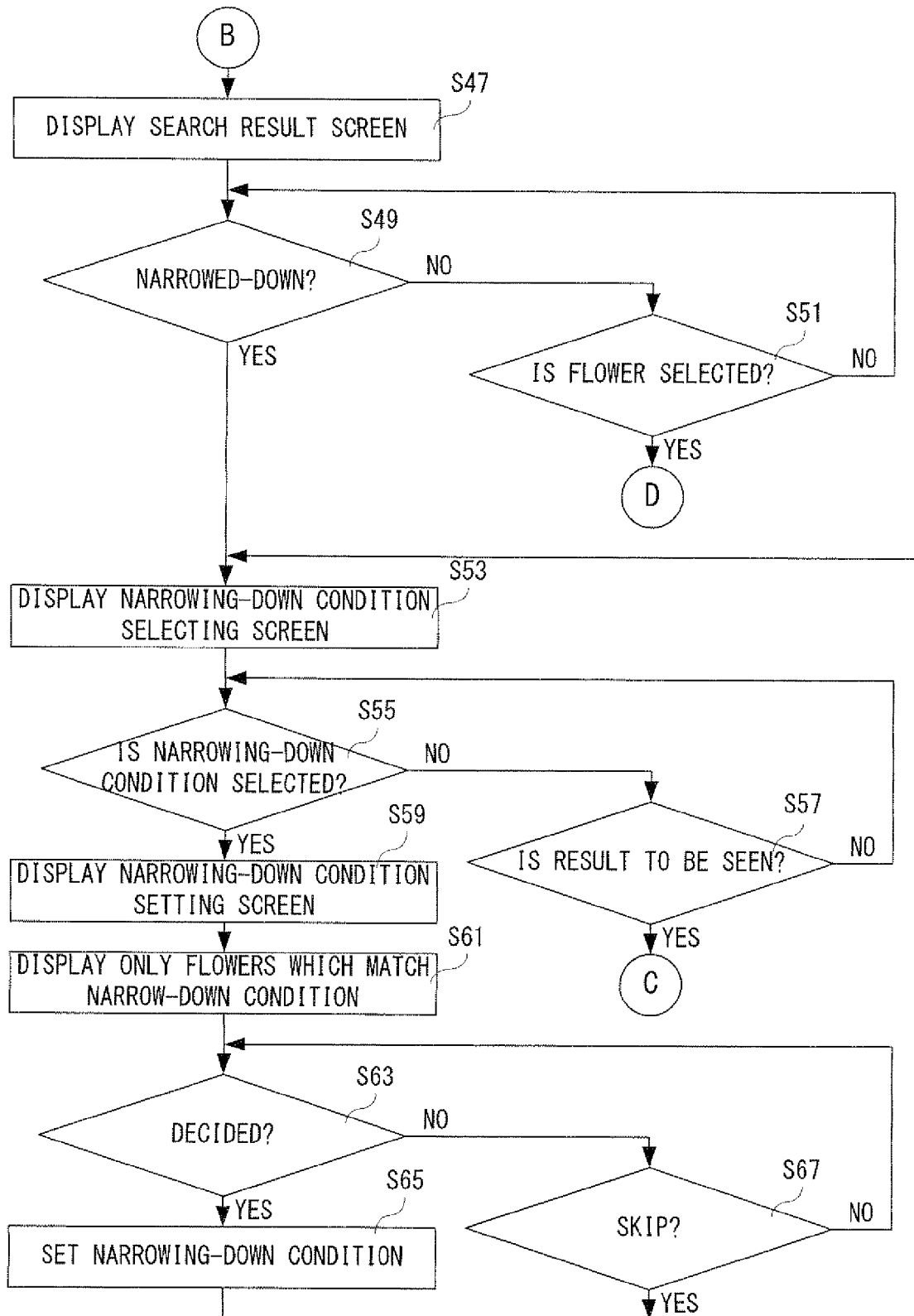


FIG. 27

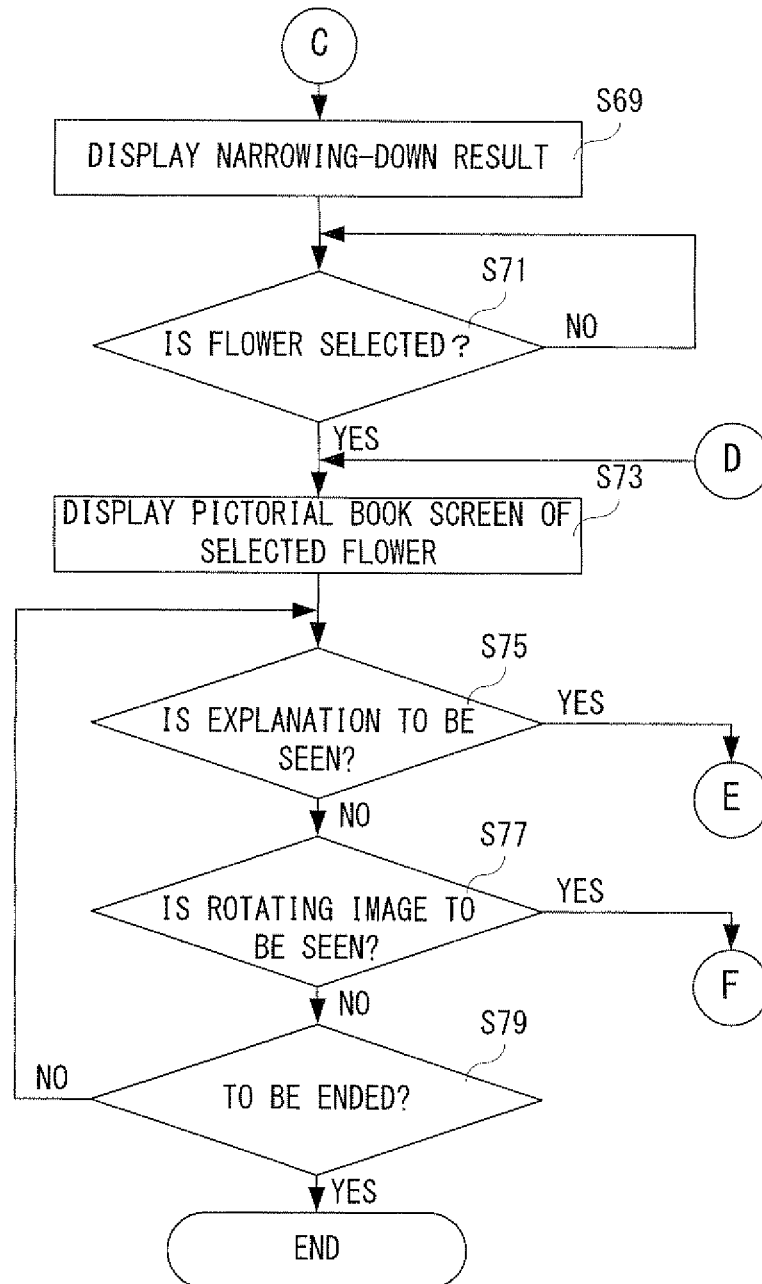


FIG. 28

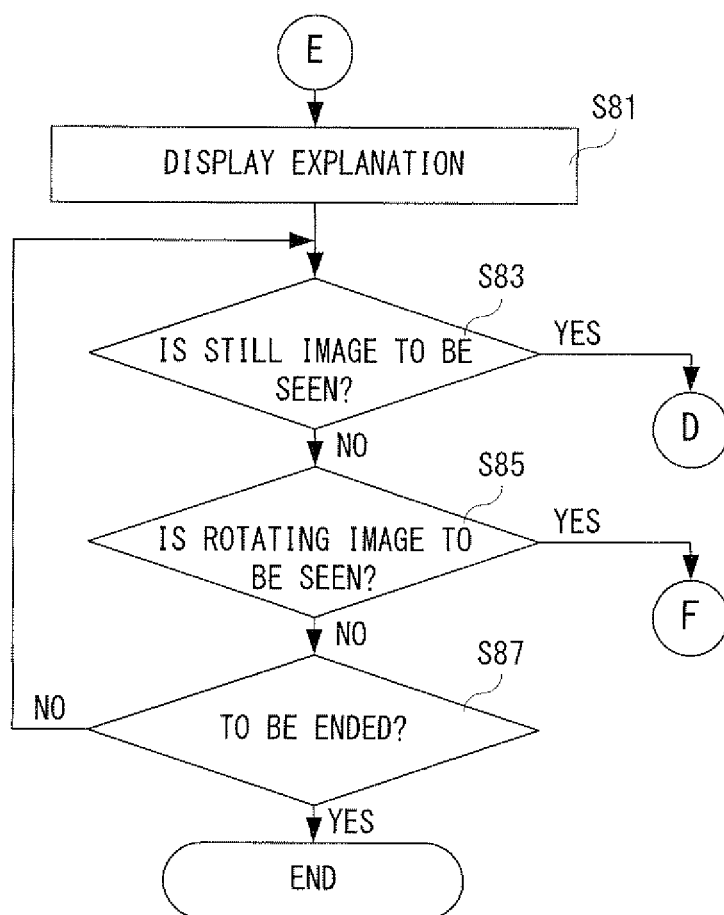
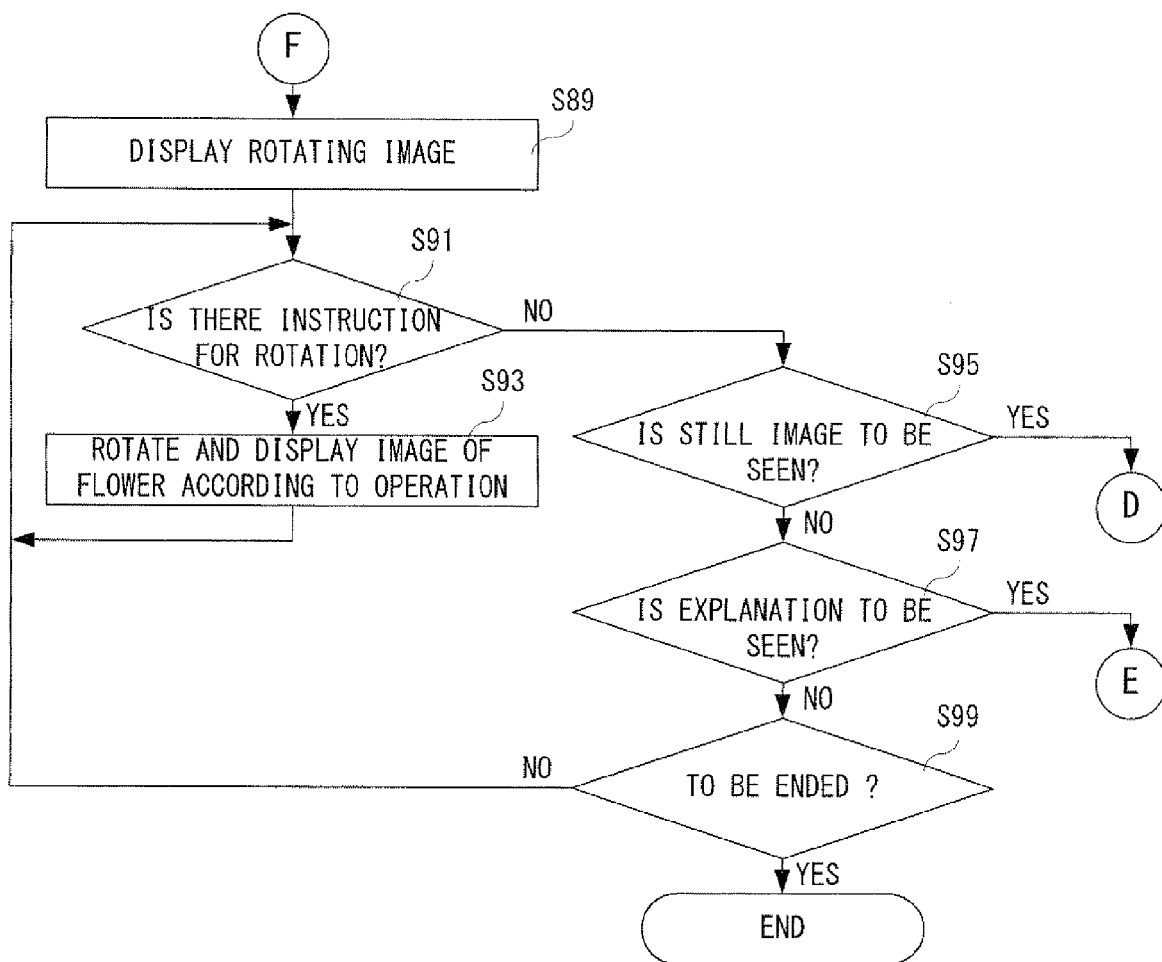


FIG. 29



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**INFORMATION PROCESSING APPARATUS,
STORAGE MEDIUM, INFORMATION
PROCESSING METHOD AND
INFORMATION PROCESSING SYSTEM FOR
PRESENTING IMAGE CANDIDATES
HAVING SIMILARITY TO AN IMAGED
IMAGE**

CROSS REFERENCE OF RELATED
APPLICATION

The disclosure of Japanese Patent Application No. 2011-86231 filed on Apr. 8, 2011 is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an information processing apparatus, storage medium, information processing method and information processing system. More specifically, the present invention relates to an information processing apparatus, storage medium, information processing method and information processing system which examines a flower based on an imaged image.

2. Description of the Related Art

One example of the related art is disclosed in a Japanese Patent Application Laying-Open No. 2003-288363 [G06F 17/30] (document 1) laid-open on Oct. 10, 2003. In an information providing device of the document 1, a predetermined feature (size, color, shape, etc. of a flower or a leaf) is extracted from an imaged object to be searched, and on the basis of a current position, a current time, etc. and the extracted feature, information of the plants having a high possibility of the object to be searched is displayed by searching a plant database. Then, in response to a selection by the user, detailed information relating to a specific plant is displayed from these plants.

Another example of the related art is disclosed in a Japanese Patent Application. Laying-Open No. 2008-152713 [G06T 1/00, G06F 17/30] (document 2) laid-open on Jul. 3, 2008. In the electronic pictorial book of the document 2, a database is searched by using a feature amount of a flower extracted by a feature extracting unit from the image of the flower imaged by a camera to thereby select candidate plants. It is determined whether or not the number of selected candidates is equal to or less than a preset threshold value by a controller. The controller displays that imaging a leaf is performed in a case that the number of selected candidates is not equal to or less than the preset threshold value. Then, the database is further searched by using the feature amount of the imaged leaf to thereby narrow down the candidates.

In the document 1 and the document 2, candidate plants are selected from all the information (data) registered in the database, resulting in high processing load and thus waste of time.

Also, the information displayed as a result is general display, being short of interest.

SUMMARY OF THE INVENTION

Therefore, it is a primary object of the present invention to provide a novel information processing apparatus, storage medium, information processing method and information processing system.

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Another object of the present invention is to provide an information processing apparatus, storage medium, information processing method and information processing system which is able to present information of high interest including a stereoscopic image as information of a search result.

A further object of the present invention is to provide an information processing apparatus, storage medium, information processing method and information processing system which is able to reduce a processing load as much as possible.

A first invention is an information processing apparatus comprising a displayer, a plurality of imagers, a judger, a reducer, a calculator, a candidate presenter, and an information presenter. The displayer allows a stereoscopic display. The plurality of imagers are provided to be flush with each other. Accordingly, the plurality of imagers simultaneously image the same object to be imaged. The judger judges the size of an object to be imaged on the basis of images imaged by the plurality of imagers. The reducer reduces the number of a plurality of search targets which are previously contained on the basis of a feature of a shape of the object to be imaged which is judged based on the images. The calculator calculates a similarity level between the object to be imaged and each of the search targets which are reduced in number by the reducer on the basis of the size of the object to be imaged and a feature of the images. The candidate presenter presents the search targets of a high similarity level calculated by the calculator as candidates. The information presenter presents information including a stereoscopic image in relation to a search target selected from the search targets as candidates presented by the candidate presenter.

According to the first invention, the number of search targets is reduced on the basis of the feature of the shape of the object to be imaged, and therefore, a load of the similarity level calculating processing can be lessened, preventing the waste of time. Furthermore, the information including the stereoscopic image is presented, and therefore, it is possible to present information of high interest. Specifically, the information of the object can be seen with the object imaged, and therefore, it is possible to compare the actual object and the stereoscopic image, capable of more enjoying the search result.

A second invention is according to the first invention, and an information processing apparatus further comprises a selector and a deleter. The selector allows a selection of a predetermined condition as to the object to be imaged. The deleter deletes the search targets which do not match the predetermined condition selected by the selector from the candidates. The candidate presenter presents the search targets as candidates which are not deleted by the deleter.

According to the second invention, the candidates for the search targets which do not match the predetermined condition are deleted, and therefore, one search target can be selected from the candidates which are narrowed down at a certain degree, capable of relatively easily selecting a desired search target.

A third invention is according to the first invention, wherein the feature of the image is color information.

According to the third invention, it is possible to present the search targets as candidates on the basis of the color of the object to be imaged.

A fourth invention is according to the first invention, wherein the feature of the image is information in relation to a shape of an object.

According to the fourth invention, it is possible to present the search targets as candidates on the basis of the shape of the object to be imaged.

A fifth invention is according to the first invention, wherein the judger includes a distance calculator which detects a parallax between the two imagers, and calculates a distance to the object to be imaged from a distance corresponding to the parallax and a set distance between the two imagers, and a size calculator which calculates the size of the object to be imaged from the distance to the object to be imaged calculated by the distance calculator and an angle of view of the imagers.

According to the fifth invention, on the basis of the parallax between the two imagers and the set distance between them, the distance to the object to be imaged is calculated, and on the basis of the calculated distance, the size is further calculated, and therefore, it is possible to easily calculate the size of the object to be imaged.

A sixth invention is according to the first invention, and an information processing apparatus further comprises a similarity level increaser. The similarity level increaser increases the similarity level when the degree of encounter of the object to be imaged is high, that is, when a frequency of view (encounter) is high.

According to the sixth invention, because the similarity level is made high in a case that the object to be imaged is often encountered, in a case that candidates for the object to be imaged are presented in the descending order of the similarity level, the candidates for the object to be imaged which are often encountered can be presented at higher ranking.

A seventh invention is a storage medium storing an information processing program of an information processing apparatus having a display which allows a stereoscopic display and a plurality of imagers which are provided to be flush with each other, the information processing program causes a computer of the information processing apparatus to function as: a judger which judges a size of an object to be imaged on the basis of images imaged by the plurality of imagers; a reducer which reduces the number of a plurality of search targets which are previously contained on the basis of a feature of a shape of the object to be imaged which is judged based on the images; a calculator which calculates a similarity level between the object to be imaged and each of the search targets which are reduced in number by the reducer on the basis of the size of the object to be imaged and a feature of the images; a candidate presenter which presents the search targets of a high similarity level calculated by the calculator as candidates; and an information presenter which presents information including a stereoscopic image in relation to a search target selected from the search targets as candidates presented by the candidate presenter.

An eighth invention is an information processing method of an information processing apparatus having a display which allows a stereoscopic display and a plurality of imagers which are provided to be flush with each other, a computer of the information processing apparatus including steps of: (a) judging a size of an object to be imaged on the basis of images imaged by the plurality of imagers; (b) reducing the number of a plurality of search targets which are previously contained on the basis of a feature of a shape of the object to be imaged which is judged based on the images; (c) calculating a similarity level between the object to be imaged and each of the search targets which are reduced in number by the step (b) on the basis of the size of the object to be imaged and a feature of the images; (d)

presenting the search targets of a high similarity level calculated by the step (c) as candidates; and (e) presenting information including a stereoscopic image in relation to a search target selected from the search targets as candidates presented by the step (d).

A ninth invention is an information processing system, comprising: a display which allows a stereoscopic display; a plurality of imagers which are provided to be flush with each other; a judger which judges a size of an object to be imaged on the basis of images imaged by the plurality of imagers; a reducer which reduces the number of a plurality of search targets which are previously contained on the basis of a feature of a shape of the object to be imaged which is judged based on the images; a calculator which calculates a similarity level between the object to be imaged and each of the search targets which are reduced in number by the reducer on the basis of the size of the object to be imaged and a feature of the images; a candidate presenter which presents the search targets of a high similarity level calculated by the calculator as candidates; and an information presenter which presents information including a stereoscopic image in relation to a search target selected from the search targets as candidates presented by the candidate presenter.

According to the seventh to ninth inventions as well, similar to the first invention, it is possible to lessen a load of the similarity level calculating processing.

The above described objects and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustrative view showing an external view of a game apparatus of one embodiment of the present invention, and shows a front surface in an opened state;

FIG. 2 is an external view of the game apparatus, FIG. 2(A) shows a top surface in a closed state, FIG. 2(B) shows a left side surface in the closed state, FIG. 2(C) shows a front surface in the closed state, FIG. 2(D) shows a right side surface in the closed state, FIG. 2(E) shows a back surface in the closed state, and FIG. 2(F) shows a bottom surface in the closed state;

FIG. 3 is an illustrative view explaining an operation of a 3D adjusting switch;

FIG. 4 is a block diagram showing one example of an electric configuration of the game apparatus;

FIG. 5 is a block diagram showing an important part (stereoscopic LCD controller being made up of a stereoscopic LCD and a part of SoC) of an electric configuration in FIG. 4;

FIG. 6 is an illustrative view explaining a principle of 3D/2D display in a parallax barrier method, FIG. 6(A) shows a state that a parallax barrier is turned on (3D display), and FIG. 6(B) shows a state that a parallax barrier is turned off (2D display);

FIG. 7 is an illustrative view showing one example of a title screen displayed on a lower LCD of the game apparatus shown in FIG. 1;

FIG. 8 is an illustrative view showing one example of an imaging screen displayed on a stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

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FIG. 9 is an illustrative view showing one example of a first condition input screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 10 is an illustrative view showing one example of a second condition input screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 11 is an illustrative view showing one example of a third condition input screen of the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 12 is an illustrative view showing one example of a search result screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 13 is an illustrative view showing one example of a narrowing-down condition selecting screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 14 is an illustrative view showing one example of a first narrowing-down screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 15 is an illustrative view showing one example of a second narrowing-down screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 16 is an illustrative view showing one example of a pictorial book screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 17 is an illustrative view showing another example of the pictorial book screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 18 is an illustrative view showing a still another example of the pictorial book screen displayed on the stereoscopic LCD and the lower LCD of the game apparatus shown in FIG. 1;

FIG. 19 is an illustrative view showing an overview of data for search;

FIG. 20 is an illustrative view describing a method of extracting color information of a flower from an image;

FIG. 21 is an illustrative view describing a method of extracting shape information of a flower from an image;

FIG. 22 is an illustrative view showing one example of a memory map of a main memory shown in FIG. 4;

FIG. 23 is an illustrative view showing an overview of pictorial book data shown in FIG. 22;

FIG. 24 is a flowchart showing a first part of flower examining processing by a CPU shown in FIG. 4;

FIG. 25 is a flowchart showing a second part of the flower examining processing by the CPU shown in FIG. 4, and being sequel to FIG. 24;

FIG. 26 is a flowchart showing a third part of the flower examining processing by the CPU shown in FIG. 4, and being sequel to FIG. 25;

FIG. 27 is a flowchart showing a fourth part of the flower examining processing by the CPU shown in FIG. 4, and being sequel to FIG. 26;

FIG. 28 is a flowchart showing a fifth part of the flower examining processing by the CPU shown in FIG. 4, and being sequel to FIG. 27; and

FIG. 29 is a flowchart showing a sixth part of the flower examining processing by the CPU shown in FIG. 4, and being sequel to FIG. 27 and FIG. 28.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 and FIG. 2 show an appearance of the game apparatus 10 being one embodiment of the present inven-

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tion. The game apparatus 10 is a foldable game apparatus, FIG. 1 shows a front of the game apparatus 10 in an opened state, FIG. 2 (A) to FIG. 2(F) respectively show a top surface, a left side surface, a front surface, a right side surface, a back surface and a bottom surface of the game apparatus 10 in a closed state.

The game apparatus 10 has an upper housing 10A and a lower housing 10B rotatably connected with each other as shown in FIG. 1, and on a top surface of the upper housing 10A, a stereoscopic LCD 12 compliant with an autostereoscopic display, an inward camera 18a, a 3D adjusting switch 20, a 3D lamp 20A, right and left speakers 22a and 22b, etc. are provided. On a top surface of the lower housing 10B, a lower LCD 14 attached with touch panel 16, A, B, X, Y buttons 24a-24d, a cross key (button) 24g, home, select, start buttons 24h-24j, a power button 24k, an analog pad 26, and a microphone 30 are provided.

Furthermore, as shown in FIG. 2(A), on the top surface of the game apparatus 10 (underside of the upper housing 10A shown in FIG. 1), right and left outward cameras 18b and 18c compliant with 3D imaging are provided. Furthermore, as shown in FIG. 2 (C), on the front surface of the game apparatus 10, a headphone terminal 36, a power lamp 42a, etc. are provided. Also, as shown in FIG. 2 (B), FIG. 2 (E) and FIG. 2 (D), from the left side surface to the back surface of the game apparatus 10, an L button 24e is provided, and from the right side surface to the back surface, an R button 24f is provided. Moreover, on the left side surface of the game apparatus 10, a volume control switch 32, an SD card slot 34, etc. are provided, and on the right side surface of the game apparatus 10, a wireless switch 28, a wireless lamp 42b, etc. are further provided. The above-described 3D adjusting switch 20 is exposed from the right side surface. In addition, on the back surface of the game apparatus 10, an infrared ray emitting-receiving unit 40, etc. is further provided. Then, as shown in FIG. 2(E) and FIG. 2(F), from the back surface to a bottom surface, a game card slot 38 is provided.

The stereoscopic LCD 12 is a 3D liquid crystal (see FIG. 6) according to a parallax barrier system, and displays a stereoscopic image without any glasses (autostereoscopic image). On the stereoscopic LCD 12, by turning a parallax barrier of the liquid crystal off, a planar image display is also made possible. It should be noted that a lenticular system utilizing a sheet with concaves/convexes (lenticular lens) and other autostereoscopic 3D systems may be adopted without being restricted to the parallax barrier system.

The inward camera 18a images a planar image (2D image) while the outward cameras 18b and 18c image stereoscopic images (3D image). A 2D or 3D image imaging a player can be used as an image input to an application program such as a game program. In this case, the game program detects movements of a face, a hand and a gazing direction (direction of eyeballs) of the player by performing image recognition, and executes processing corresponding to the detection result. The 2D image by the inward camera 18a can be displayed on the lower LCD 14, and the 3D images by the outward cameras 18b and 18c can be displayed on the stereoscopic LCD 12.

The 3D adjusting switch 20 is a slide switch for manually switching, as to the display of the stereoscopic LCD 12, between the 3D display and the 2D display, and manually adjusting a three-dimensional effect in the 3D display as well, and operates as shown in FIG. 3, for example. The three-dimensional effect of the 3D display becomes a maximum (Sd=1) when the slider Sd is at an upper end, decrease as the slider Sd is moved down, and becomes a minimum

(Sd=0) when at a lower end in this embodiment. Then, the 3D display changes to the 2D display when the slider Sd is moved to the lower end.

Although the detailed description is omitted, such a change of the three-dimensional effect of the 3D display is implemented by changing the distance (distance-between cameras D) between the right and left virtual cameras (not shown) arranged within the virtual space. That is, according to an operation of the 3D adjusting switch 20, the distance-between cameras D is adjusted. Then, the distance-between cameras D undergoes an automatic adjustment by the game program as well as such a manual adjustment.

The 3D lamp 20A is a lamp showing a displaying condition of the stereoscopic LCD 12, and lights up in the 3D display and lights off in the 2D display. Here, it may be changed in brightness and color in correspondence with the degree of the 3D display (intensity of the three-dimensional effect) as well as it merely lights up and off.

An operation to the touch panel 16, the A, B, X, Y buttons 24a-24d, the cross key (button) 24g, the home, select, start buttons 24h-24j, or the analog pad 26 is used as a touch/button/pad input to the game program. The power button 24k is used for turning on or off the power of the game apparatus 10. The power lamp 42a lights up or off in conjunction with the power-on or the power-off of the power source.

The microphone 30 converts a speech voice by a player, an environmental sound, etc. into sound data. The sound data can be used as a sound input to the game program. In this case, the game program detects the speech voice by the player by performing voice recognition, and executes processing according to the detection result. The sound data by the microphone 30 can be further recorded in a NAND-type flash memory 48 (see FIG. 4), etc.

The speakers 22a and 22b output a game voice, a microphone voice, etc. To the headphone terminal 36, a headphone not shown is connected. The volume control switch 32 is a slide switch for adjusting volumes of the speakers 22a and 22b or an output from the headphone terminal 36.

The SD card slot 34 is attached with an SD memory card (not illustrated) for saving a camera image, a microphone sound, etc., and the game card slot 38 is attached with a game card (not illustrated) storing the game program, etc. The infrared ray emitting-receiving unit 40 is utilized for infrared rays (IR) communications with other game apparatuses.

FIG. 4 shows an electric configuration of the game apparatus 10. The game apparatus 10 includes an SoC (System-on-a-Chip) 44 being made up of a CPU, a GPU, a VRAM, a DSP, etc. The SoC 44 is connected with the above-described stereoscopic LCD 12, lower LCD 14, inward camera (In camera) 18a, right and left outward cameras (OCAM-L and OCAM-R) 18b and 18c, A, B, X, Y, L, R buttons 24a-24f, cross button 24g, SD card slot 34, game card slot 38, and infrared ray emitting-receiving unit (IR) 40. The SoC 44 is further connected with the above-described 3D adjusting switch (3D Vol) 20, 3D lamp 20A, home, select, start buttons 24h-24j, power button (Power) 24k, wireless switch (WiFi) 28, volume control switch (volume Vol) 32, and power, wireless lamps 42a, 42b via a microcomputer (hereinafter referred to as "micon") 56. The SoC 44 is moreover connected with the above-described touch panel 16, right and left speakers 22a and 22b, analog pad 26, microphone (Mic) 30 and headphone terminal 36 via an IF circuit 58.

In addition, the SoC 44 is connected with a wireless module 46, the NAND-type flash memory 48 and a main memory 50 as elements other than the above description.

The wireless module 46 has a function of connecting to a wireless LAN. Thus, although illustration is omitted, the game apparatus 10 can communicate with other game apparatuses and computers directly or via a network. The NAND-type flash memory 48 stores data to be saved, such as a camera image, a microphone voice, etc. The main memory 50 gives a working area to the SoC 44. That is, in the main memory 50, various data and programs to be used in the application such as a game are stored, and the SoC 44 performs works by utilizing the data and program stored in the main memory 50.

The microcomputer 56 is connected with a power source management IC 52 and an acceleration sensor 54. The power source management IC 52 performs a power source management of the game apparatus 10, and the acceleration sensor 54 detects accelerations in the three-axis directions of the game apparatus 10. The detection result by the acceleration sensor 54 is available as a motion input to the game program. In this case, the game program calculates the movement of the game apparatus 10 itself on the basis of the detection result, and execute processing according to the calculation result. Also, the microcomputer 56 includes an RTC (real-time clock) 56a, and counts a time by the RTC 56a to supply it to the SoC 44.

FIG. 5 shows a stereoscopic LCD controller 12A being made up of the stereoscopic LCD 12 and a part of the SoC 44. The stereoscopic LCD 12 includes an LCD controller 12a, a barrier liquid crystal 12b and an upper LCD 12c. The barrier liquid crystal 12b includes a plurality of liquid crystal slits extending in a vertical (row) direction as shown in FIG. 6(A), and makes the right eye and the left eye view beams passing through pixels in a different row of the upper LCD 12c by alternately cutting off the beam from the backlight by the plurality of liquid crystal slits. The upper LCD 12c may be a general liquid crystal (for 2D display) similar to the lower LCD 14. The LCD controller 12a performs drawing on the upper LCD 12c under the control of the CPU 44b and then the CPU 44a, and turns the barrier liquid crystal 12b (applied voltage thereto) on and off. When the barrier liquid crystal 12b is turned off, the right eye and the left eye can view the beams passing through the pixels of all the rows on the upper LCD 12c as shown in FIG. 6(B).

Here, FIG. 5 shows that the LCD controller 12a, the GPU 44b and the VRAM 44c are provided by bringing them into correspondence with the stereoscopic LCD 12, and naturally, the LCD controller, the GPU and the VRAM are also provided bringing them into correspondence with the lower LCD 14. As can be understood from FIG. 5, the GPU corresponding to the lower LCD 14 is also connected to the CPU 44a so as to be able to transmit and receive signals, and the GPU corresponding to the lower LCD 14 and the VRAM are connected with each other so as to be able to transmit and receive signals. Then, the CPU 44a, the CPU corresponding to the lower LCD 14 and the VRAM each is connected to the LCD controller corresponding to the lower LCD 14 so as to be able to transmit and receive signal, so that the lower LCD 14 is connected to this LCD controller.

For example, when the power button 24k is turned on to turn the power source of the game apparatus 10 on, the game apparatus 10 is started up to display a main menu screen not shown on the lower LCD 14. On the main menu screen, execution of an application, such as a virtual game, that can be executed with the game apparatus 10 can be instructed. Also, depending on the kind of the virtual game, by making communications with two or more game apparatuses 10, a virtual game (communication game) can be played.

FIG. 7 is an illustrative view showing one example of a title screen **100** of an application to be executed in the aforementioned game apparatus **10** of this embodiment. For example, this application is for examining an object (flower in this embodiment) imaged by using an imaging function of the game apparatus **10** in an electronic pictorial book, seeing the examined result, and further viewing the imaged image of the flower at a virtual gallery.

As shown in FIG. 7, the title screen **100** includes an upper screen **100a** and a lower screen **100b**. The upper screen **100a** is displayed on the stereoscopic LCD **12**, and the lower screen **100b** is displayed on the lower LCD **14**. This holds true for each screen shown below. On the upper screen **100a**, the title of this application is displayed in characters (text, etc.) Although the illustration is omitted, on the upper screen **100a**, a background image is also displayed.

Furthermore, on the lower screen **100b**, a button image **102**, a button image **104** and a button image **106** for selecting a menu executable in this application are displayed. The button image **102** is provided for seeing the electronic pictorial book. The button image **104** is provided for examining a flower imaged by the cameras (**18b**, **18c**) (hereinafter, sometimes referred to as “flower examination with camera”). The button image **106** is provided for viewing an image of a flower imaged by the user in the virtual gallery.

It should be noted that selecting and executing a pictorial book function and a gallery function on the title screen **100** are not essential matters of the present application, and thus, the detailed description thereof is omitted.

For example, when the button image **104** is turned on (touched) on the title screen **100**, a flower examining function with camera is executed (started) to display an imaging screen **150** as shown in FIG. 8 on the stereoscopic LCD **12** and the lower LCD **14**. Although the detailed description is omitted, when the flower examining function with camera is started, an imaging mode is set to activate outward cameras **18b**, **18c**. The imaging screen **150** includes an upper screen **150a** and a lower screen **150b**.

On the upper screen **150a**, a display region **152** is provided at the upper part thereof, and a display region **154** is provided below the display region **152** at the center of the upper screen **150a**. Furthermore, a display region **156** is provided on the left of the display region **154**, and a display region **158** is provided on the right of the display region **154**.

In the display region **152**, that the flower examining function with camera is being executed, imaging is now being made and the progress status of the function are indicated in characters, or the like. In the display region **154**, a through image relating to the images imaged by the outward cameras **18b** and **18c** is displayed in this display region **154**, a circle (round frame) designation image **154a** is displayed. This is because imaging a flower is made by aligning on the circle (round frame) of the designation image **154a**. Accordingly, the size of the circle of the designation image **154a** is fixed. In the display region **156**, the color of the flower which is being imaged is displayed. In this embodiment, in the display region **156**, an image of the flower with the color of the flower which is being imaged is displayed. In the display region **158**, the size of the flower is displayed. Here, the size of the flower is calculated on the basis of the fact that the flower is imaged in such a size as to fit into the designation image **154a** shown within the display region **154**.

Furthermore, on the imaging screen **150**, between the display region **152** and the display region **156**, a zoom magnification of the outward cameras **18b**, **18c** is displayed. Also, on the imaging screen **150**, date and time information

(Christian era, month, date, hour, minute) is displayed between the display region **152** and the display region **158**. In addition, on the imaging screen **150**, a message that imaging the flower is made by aligning on the frame of the designation image **154a** is displayed below the display regions **154** to **158**.

On the lower screen **150b**, at the center of the screen, a button image **160**, a button image **162** and a button image **164** are displayed. At the lower part of the lower screen **150b**, a button image **166** is also provided.

The button image **160** is provided for setting the zoom magnification of the outward cameras **18b**, **18c** to 1. The button image **162** is provided for setting the zoom magnification of the outward cameras **18b**, **18c** to 2. Accordingly, in response to the button image **160** or the button image **162** being turned on (touched), the zoom magnification of each of the outward cameras **18b**, **18c** is changed. Alternatively, as shown in the button image **160** and the button image **162**, by operating the left push button or the right push button of the cross key **24g**, a zoom magnification can be changed.

Similarly, in a case that a design of the operating switch or key is displayed in the button image below, by operating the operating switch or the key indicated by the design, an instruction when the button image is turned on (touched) is input. Here, this is not the essential matter of the present application and therefore, the description thereof is omitted below.

The button image **164** is provided for imaging. That is, the button image **164** corresponds to a shutter button. When the button image **164** is turned on (touched), imaging processing is executed by the outward cameras **18b**, **18c** to capture the still image at this point as an imaged image. Accordingly, imaged images as to the same object (subject) can simultaneously be obtained by the outward cameras **18b**, **18c**.

The button image **166** is provided for returning to the title. When the button image **166** is turned on (touched), the imaging processing is stopped to return to the title screen **100** shown in FIG. 7.

In FIG. 8, when the button image **164** is turned on to execute imaging processing by the cameras **18b**, **18c**, a first condition input screen **200** as shown in FIG. 9 is displayed on the stereoscopic LCD **12** and the lower LCD **14**. The first condition input screen **200** includes an upper screen **200a** and a lower screen **200b**.

The upper screen **200a** is provided with a display region **202** at the upper part thereof. Furthermore, a display region **204** is provided on the left of the center of the upper screen **200a**, and a display region **206** is provided below it. Also, a display region **208** is provided on the right of the center of the upper screen **200a**, and a display region **210** is provided below it. Then, between the display region **202**, and the display region **204** and the display region **208**, a display region **212** is provided.

In the display region **202**, that the flower-examination-with-camera mode is being executed, this is a screen for searching for a flower, and the progress status of the mode are indicated in characters, or the like. In the display region **204**, a current imaged image is displayed. As described above, imaging a flower is made by aligning on the designation image **154a**, and therefore, an image of the flower is basically displayed in the display region **204**. In the display region **206**, a message that the image displayed in the display region **204** is an image of the imaged flower is described.

In the display region **208**, images representing examples of how flowers bloom are displayed. The images displayed in the display region **208** correspond to any one of the button

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images **222**, **224**, **226** displayed on the lower screen **200b** described later. Furthermore, in the display region **210**, a content indicating that the images displayed in the display region **208** correspond to which example showing how flowers bloom is displayed in text form. In addition, in the display region **212**, a simple explanation of the image displayed in the display region **208** is displayed in text form.

On the lower screen **200b**, a display region **220** is displayed at the upper part thereof, and button images **222**, **224**, **226**, **228**, **230**, **232**, **234** are displayed below the display region **220**. The button images **222-228** are provided for selecting how flowers bloom. When any one of the button images **222-226** is selected, images representing examples showing how flowers bloom are displayed in the display region **208**. When the button image **222** is turned on, blooming singly or thinly is selected. When the button image **224** is turned on, blooming thickly is selected. In addition, when the button image **226** is turned on, blooming in long clusters is selected. Moreover, when the button image **228** is turned on, a manner except for how flowers bloom selected by the button images **222-226** is selected. When button image **230** is turned on, not selecting (skipping the selection of) how flowers bloom is turned on.

It should be noted that on the first condition input screen **200** shown in FIG. 9, the button image **222** is selected, and the selecting state is represented by the heavy-line frame of the button image **222**. Here, the brightness of the selected button image is heightened, the color of the background of the selected button image is changed, or unselected button images are inverted in color or grayed out to thereby represent the selected button image. This holds true for a case that the button image is selected below.

The button image **232** is provided for selecting imaging of a flower again. When the button image **232** is turned on, the screen returns to the imaging screen **150** in FIG. 8 in order to image again. At this time, the data of the image previously imaged (imaged image data) is annulled (deleted). Furthermore, the button image **234** is provided for deciding the content of the selected one of the button images **222-230**.

When the button image **234** is turned on to decide the content (first condition) assigned to the selected one of the button images **222-230**, a second condition input screen **250** shown in FIG. 10 is displayed on the stereoscopic LCD **12** and the lower LCD **14**. The second condition input screen **250** includes an upper screen **250a** and a lower screen **250b**.

On the upper screen **250a**, a display region **252** is provided at the upper end thereof. Furthermore, a display region **254** is provided on the left of the center of the upper screen **250a**, and a display region **256** is provided below it. Also, a display region **258** is provided on the right of the center of the upper screen **250a**, and a display region **260** is provided below it. Then, between the display region **252**, and the display region **254** and the display region **258**, a display region **262** is provided.

In the display region **252**, that the flower-examination-with-camera mode is being executed, this is a screen for searching for a flower, and the progress status of the mode are indicated in characters, or the like. In the display region **254**, a current imaged image is displayed. In the display region **256**, a message that the image displayed in the display region **254** is an image of the imaged flower is described.

In the display region **258**, images showing examples of the shape of the flower are displayed. The images displayed in this display region **258** correspond to any one of button images **272**, **274**, **276**, **278**, **280**, **282**, **284** displayed on the lower screen **250b** described later. Also, in the display region

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260, a content indicating that the images displayed in the display region **258** correspond to which example showing the shape of the flower is displayed in text form. In addition, in the display region **262**, an explanation of the image displayed in the display region **258** is displayed in text form.

On the lower screen **250b**, a display region **270** is provided at the upper part thereof, and the button images **272**, **274**, **276**, **278**, **280**, **282**, **284**, **286**, **288**, **290**, **292** are displayed below the display region **270**. The button images **272-284** are provided for selecting the shape of a flower. When any one of the button images **272-284** is selected, images showing examples of the shape of the flower corresponding thereto are displayed in the display region **258**.

For example, when the button image **274** is turned on, selecting three petals is made. When any one of the button images **274-278** is turned on, selecting different numbers of petals is made. Furthermore, when the button image **280** is selected, selecting many petals is made. In addition, when the button image **282** is turned on, selecting a trumpet-shaped or bell-shaped petal is made. Then, when the button image **284** is turned on, selecting a shape of the flower except for a circle is made. Moreover, when the button image **286** is turned on, selecting a shape other than the shapes selected by the button images **272-284** is made. Then, when the button image **288** is turned on, not selecting (skipping the selection of) the shape of the flower is selected.

The button image **290** is provided for instructing a return to the previous screen. In this embodiment, when the button image **290** is turned on, the screen returns to the first condition input screen **200** shown in FIG. 9. The button image **292** is provided for deciding the content of the selected one of the button images **272-288**.

When the button image **292** is turned on to decide the content (second condition) assigned to the selected button images **272-282**, a third condition input screen **300** as shown in FIG. 11 is displayed on the stereoscopic LCD **12** and the lower LCD **14**. The third condition input screen **300** includes an upper screen **300a** and a lower screen **300b**.

On the upper screen **300a**, a display region **302** is provided at the upper part thereof. Furthermore, a display region **304** is provided on the left of the center of the upper screen **300a**, and a display region **306** is provided below it. Also, a display region **308** is provided on the right of the center of the upper screen **300a**, and a display region **310** is provided below it. Then, between the display region **302**, and the display region **304** and the display region **308**, a display region **312** is provided.

In the display region **302**, that the flower-examination-with-camera mode is being executed, this is a screen for searching for a flower, and the progress status of the mode are indicated in characters, or the like. In the display region **304**, a current imaged image is displayed. In the display region **306**, a message that the image displayed in the display region **304** is an image of the imaged flower is described.

In the display region **308**, images showing examples of a grass flower, a tree flower or a climbing plant are displayed. The images displayed in this display region **308** correspond to any one of button images **322**, **324**, **326** displayed on the lower screen **300b** described later. Furthermore, in the display region **310**, a content indicating that the image displayed in the display region **308** is an example of which kind of flowers is described in text form. In addition, in the display region **312**, an explanation of the image displayed in the display region **308** is displayed in text form.

On the lower screen **300b**, a display region **320** is provided at the upper part thereof, and the button images **322**,

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324, 326, 328, 330, 332 are displayed below the display region 320. The button images 322-326 are provided for respectively selecting the grass flower, the tree flower and the climbing plant. When any one of the button images 322-326 is selected, the aforementioned images corresponding thereto are displayed in the display region 308.

For example, when the button image 322 is turned on, selecting the grass flower is made. When the button image 324 is turned on, selecting the tree flower is made. Then, when the button image 326 is turned on, selecting the climbing plant is made. Moreover, when the button image 328 is turned on, not selecting (skipping the selection of) each of the grass flower, the tree flower, and the climbing plant is selected.

The button image 330 is provided for instructing a return to the previous screen. In this embodiment, when the button image 330 is turned on, the screen returns to the second condition input screen 250 shown in FIG. 10. Furthermore, the button image 332 is provided for deciding the content of the selected button images 322-328.

When the button image 332 is turned on to decide the content (third condition) assigned to the selected one of the button images 322-328, a search result screen 350 as shown in FIG. 12 is displayed on the stereoscopic LCD 12 and the lower LCD 14. The search result screen 350 includes an upper screen 350a and a lower screen 350b. Although the search result screen 350 is described below, but contents the same as those in each screen described before are omitted.

As shown in FIG. 12, on the upper screen 350a, a display region 352 is provided at the upper part thereof. Furthermore, a display region 354 is provided at the left of the center of the upper screen 350a, and a display region 356 is provided below it. Also, a display region 358 is provided at the right of the center of the upper screen 350a, and a display region 360 is provided below it. Then, between the display region 352, and the display region 354 and the display region 358, a display region 362 is provided.

In the display region 352, that the flower-examination-with-camera mode is being executed, this is a screen for searching for a flower, and the progress status of the mode are indicated in characters, or the like. In the display region 354, a current imaged image is displayed. In the display region 356, a message that the image displayed in the display region 354 is an image of the imaged flower is described.

In the display region 358, an image of the flower as a search result is displayed. The image displayed in this display region 358 is an image (normal image) of a normal size corresponding to a reduced image displayed in a display region 374 displayed on the lower screen 350b described later. Furthermore, in the display region 360, a name of the flower represented by the normal image displayed in the display region 358 is displayed in text form. In addition, in the display region 362, a simple explanation of the flower represented by the normal image displayed in the display region 358 is displayed in text form.

On the lower screen 350b, at the upper left thereof, a display region 370 is provided, and on the right thereof, a button image 372 is displayed. Furthermore, below the display region 370 and the button image 372, a display region 374 is provided, and on the right of the display region 374, a scroll button image 376 is displayed. In addition, at the lower part of the lower screen 350b, a button image 378 and a button image 380 are displayed.

In the display region 370, the number of candidates as a search result based on the imaged image is displayed. The button image 372 is provided for further narrowing down the

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candidates from the search result. In the display region 374, images of flowers (reduced images) as a search result are displayed in the descending order of the degree of similarity (similarity level). The scroll button image 376 includes button images 376a, 376b, 376c. In this embodiment, by turning on the button image 376a or the button image 376b, or by sliding the button image 376c, the reduced images displayed in the display region 374 can be moved up and down. Accordingly, in a case that there are many reduced images as a search result, the entire search result (reduced images as candidates) can be seen by scrolling the screen.

For example, by touching a reduced image, a flower which matches the flower included in the imaged image by the outward cameras 18b, 18c can be selected from the search result. In the example of the search result screen 350 shown in FIG. 12, the reduced image having the highest similarity level (first place) is selected.

Although the detailed description is omitted, at the beginning of displaying the search result screen 350, the reduced image of the highest similarity level is selected on the lower screen 350b.

The button image 378 is provided to instruct selecting of imaging again. In this embodiment, when the button image 378 is turned on, imaging again is selected as described above to return to the imaging screen 150 shown in FIG. 8. Furthermore, a button image 380 is provided for seeing the detail (detailed information) of the flower represented by the selected image out of the entire search result. In this embodiment, as detailed information, classification of a flower (family name, generic name), information about the country of origin, a still image and a rotating image are included. Although the detailed description is omitted, these pieces of detailed information are coincident with viewable information when a normal electronic pictorial book mode is executed. Furthermore, as described later, the still image is a stereoscopic image, and the rotating image is a stereoscopic image capable of making a 36° rotation in the lateral direction (horizontal direction).

For example, when the button image 372 is turned on on the search result screen 350 in FIG. 12, a narrowing-down condition selecting screen 400 as shown in FIG. 13 is displayed on the stereoscopic LCD 12 and the lower LCD 14. The narrowing-down condition selecting screen 400 includes an upper screen 400a and a lower screen 400b.

As shown in FIG. 13, on the upper screen 400a, a display region 402 is provided at the upper end thereof. Furthermore, a display region 404 is provided on the left of the center of the upper screen 350a, and a display region 406 is provided below it. Also, on the right of the display region 404 and the display region 406, a display region 408 is provided. Then, between the display region 402 and the display region 408, a display region 410 is provided.

In the display region 402, that the flower-examination-with-camera mode is being executed, this is a screen for displaying a search result of the flower, and the progress status of the mode are indicated in characters, or the like. In the display region 404, a current imaged image is displayed. In the display region 406, a message that the image displayed in the display region 404 is an image of the imaged flower is described.

In the display region 408, reduced images of flowers as a search result are displayed in the descending order of the degree of similarity. In the example shown in FIG. 13, up to eight reduced images are displayed. In the display region 410, the number of flowers matching the selected condition is described. Here, the narrowing-down condition selecting screen 400 shown in FIG. 13 is a state before a condition is

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selected and set, and thus, the number of the search result shown in FIG. 12 is displayed as it is.

On the lower screen 400b, a display region 420 is provided at the upper end thereof, and a button image 422 is displayed within this display region 420. Also, below the display region 420, a display region 424 is provided, and below the display region 424, a button image 426 and a button image 428 are displayed.

In the display region 420, on the left of the button image 422, selecting a condition on the lower screen 400b is described. The button image 422 is provided for returning to the initial state. Thus, when the button image 422 is turned on, the set narrowing-down conditions are all cleared to return to a state in which no narrowing-down condition is set.

In the display region 424, a plurality of button images for selecting various narrowing-down conditions are displayed. Although illustration is omitted, by scrolling the screen right and left, button images for selecting other narrowing-down conditions are displayed on the display region 424. Here, in FIG. 13, a state in which no narrowing-down condition is selected is shown.

The button image 426 is provided for selecting imaging again. The button image 426 is the same as the above-described button image 232 and button image 378. The button image 428 is provided for seeing the result. When the button image 428 is turned on, reduced images of the flowers which satisfy one or a plurality of set narrowing-down conditions out of the search result are displayed in the display region 408 although illustration is omitted, and the number is displayed in the display region 410.

Additionally, when a button image of height of plant, for example, is turned on on the narrowing-down condition selecting screen 400 shown in FIG. 13, a narrowing-down condition setting screen 450 as shown in FIG. 14 is displayed on the stereoscopic LCD 12 and the lower LCD 14. It should be noted that as to the narrowing-down condition setting screen 450, on the lower screen 450b, a state in which the height of the plant is changed (selected) by utilizing a scroll button image 476 described later. As shown in FIG. 14, the narrowing-down condition setting screen 450 relating to the height of the plant includes an upper screen 450a and a lower screen 450b.

On the upper screen 450a, a display region 452 is provided at the upper part thereof. Furthermore, on the left of the center of the upper screen 450a, a display region 454 is provided, and below it, a display region 456 is provided. Also, on the right of the display region 454 and the display region 456, a display region 458 is provided. Then, between the display region 452 and the display region 458, a display region 460 is provided.

The upper screen 450a is the same as the upper screen 400a shown in FIG. 13 except for that the reduced images of the flowers as candidates obtained by being narrowed down under the condition of the height of the plant selected on the lower screen 450b are displayed on the display region 458, and the number of candidates is displayed in the display region 460, and therefore, a redundant description is omitted.

On the lower screen 450b, a display region 470 is provided at the upper end of thereof, and below the display region 470, a display region 472 is provided. In addition, below the display region 472, a display region 474 is provided, and on the right side of the display region 474, a scroll button image 476 is displayed. In addition, at the lower end of the lower screen 450b, a button image 478 and a button image 480 are displayed.

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In the display region 470, a message that the lower screen 450b is a plant height setting screen is described. In the display region 472, the height of the plant is illustrated. In the display region 474, the current set value of the height of the plant is displayed. The scroll button image 476 includes button images 476a, 476b, 476c. By turning on the button image 476a and the button image 476b, or sliding the button image 476c, the height of the plant is changed. At this time, the illustrated height of the plant in the display region 472 is changed, or the set value of the height of the plant in the display region 474 is changed.

The button image 478 is provided for selecting (skipping the setting) not setting the height of the plant. Thus, when the button image 478 is turned on, the screen returns to the narrowing-down condition selecting screen 400 shown in FIG. 13 without setting the condition of the height of the plant. Also, the button image 480 is provided for setting (deciding) the height of the plant. Accordingly, when the button image 480 is turned on, the height of the plant set by using the scroll button image 476 is set as a narrowing-down condition, and the screen returns to the narrowing-down condition selecting screen 400 shown in FIG. 13.

Alternatively, when a button image of the direction of the flower is turned on on the narrowing-down condition selecting screen 400 shown in FIG. 13, a narrowing-down condition setting screen 500 relating to the direction of the flower as shown in FIG. 15 is displayed on the stereoscopic LCD 12 and the lower LCD 14. It should be noted that as to the narrowing-down condition setting screen 500, a state in which selecting an upward direction as a direction of the flower is made is displayed on the lower screen 500b. The narrowing-down condition setting screen 500 also includes an upper screen 500a and a lower screen 500b.

As shown in FIG. 15, on the upper screen 500a, a display region 502 is provided at the upper end thereof. Furthermore, on the left of the center of the upper screen 500a, a display region 504 is provided, and a display region 506 is provided below it. Additionally, on the right of the display region 504 and the display region 506, a display region 508 is provided. Then, between the display region 502 and the display region 508, a display region 510 is provided.

The upper screen 500a is the same as the above-described upper screens 400a and 450a except for that the reduced images as candidates obtained by being narrowed down under the condition of the direction of the flower selected on the lower screen 500b are displayed in the display region 508, and the number of candidates are displayed in the display region 510, and therefore, a redundant description is omitted.

Furthermore, on the lower screen 500b, at the upper end thereof, a display region 520 is provided, and below the display region 520, a button image 522, a button image 524, a button image 526 and a button image 528 are displayed. In addition, at the lower right of the lower screen 500b, a button image 530 is displayed.

In the display region 520, a message that the lower screen 500b is a screen for setting the direction of the flower is described. The button images 522, 524, 526 are provided for selecting the direction of the flower. When the button image 522 is turned on, an upward direction is selected as a condition of the direction of the flower. When the button image 524 is turned on, a downward direction is selected as a condition of the direction of the flower. When the button image 526 is turned on, a direction other than the upward direction and downward direction is selected as a condition of the direction of the flower. Also, the button image 528 is

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provided for selection of not selecting (skipping the selection of) the direction of the flower.

When the button image **530** is turned on in a state that any one of the button images **522-528** is selected (turned on), setting the selected direction of the flower as a condition is made, and not setting the direction of the flower as a condition is made.

In addition, when the button image **428** is turned on on the narrowing-down condition selecting screen **400** in FIG. **13** in a state that the narrowing-down condition is set, a narrowing-down result screen is displayed although illustration is omitted. For example, the reduced images of the flowers obtained by being narrowed down are displayed in the display region **424** of the lower screen **400b**. Although illustration is omitted, the screen as a result of narrowing down (narrowing-down result screen) is similar to the search result screen **350** shown in FIG. **12**, and the reduced images of the flowers obtained by being narrowed down are displayed in the display region **374** in the descending order of the degree of similarity.

In a case that the button image **428** is turned on in a state that no narrowing-down condition is set, a narrowing-down result screen approximately the same as the search result screen **350** shown in FIG. **12** is displayed.

Additionally, when a reduced image of a flower which seems to be the same as the imaged flower is selected on the narrowing-down result screen, the detailed information is displayed. The detailed information is as described above, and a pictorial book screen **550** as shown in FIG. **16**, for example, is displayed on the stereoscopic LCD **12** and the lower LCD **14**. The pictorial book screen **550** includes an upper screen **550a** and a lower screen **550b**.

As shown in FIG. **16**, the upper screen **550a** is provided with a display region **552** at the upper end thereof and a display region **554** except for the display region **552**. In the display region **552**, displaying the electronic pictorial book and the name of the flower displayed in the display region **554** are displayed in characters, or the like. In the display region **554**, an image of a flower is displayed at the center. Here, the image displayed here is a still image corresponding to the reduced image selected by the user on the search result screen **350** and the narrowing-down result screen. The still image can be stereoscopic. Also, at the lower end of the display region **554**, classification of a flower (family name, generic name), and information about the country of origin as to the flower displayed in the display region **554** are displayed in telops. Here, as described later, the telop can be select between display and non-display.

On the lower screen **550b**, a display region **560** is provided at the upper end thereof, and below the display region **560**, button images **562**, **564**, **566** are displayed. Furthermore, below the button images **562-566**, a display region **568** is provided, and below the display region **568**, a button image **572** and a button image **574** are displayed.

In the display region **560**, the name of the flower, etc. displayed on the upper screen **550a** is displayed in characters, or the like. The button images **562**, **564**, **566** are provided for respectively displaying a still image, an explanation, and a rotating image out of the detailed information. When the button image **562** is turned on, a still image of the flower displayed in the display region **560** is displayed in the display region **554** of the upper screen **550a**. At the beginning of displaying the pictorial book screen **550**, the button image **562** has been turned on, and this state is shown in FIG. **16**. The still image is an image of stereograph (stereoscopic image).

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When the button image **564** is turned on, an explanation of the flower displayed in the display region **560** is displayed in the display region **554** of the upper screen **550a**. Although illustration is omitted, as an explanation, for example, an image (imaged image) as to the flower displayed in the display region **552** and display region **560** is displayed, and the explanation of the flower is displayed in text form. Although illustration is omitted, when the button image **564** is turned on, at least a scroll button image is displayed in the display region **568**, and by using this, the region where the explanation is displayed can be scrolled.

When the button image **566** is turned on, a rotating image (rotatable stereoscopic image) of the flower displayed in the display region **560** is displayed in the display region **554** of the upper screen **550a**. More specifically, as described later, the pictorial book screen **550** as shown in FIG. **17** and FIG. **18** is displayed on the stereoscopic LCD **12** and the lower LCD **14**. Here, at the beginning of turning on the button image **566**, the pictorial book screen **550** shown in FIG. **17** is displayed.

Returning to FIG. **16**, in the display region **568**, button images as to operations in relation to the respective button images **562-566** are displayed. As shown in FIG. **16**, while the button image **562** is turned on, the button image **570** is displayed in the display region **568**. The button image **570** is for hiding a telop (non-display).

Although illustration is omitted, in a case that a telop is displayed on the upper screen **550a** as shown in FIG. **16**, the button image **570** is used for inputting an instruction of hiding a telop, but in a case that a telop is not displayed, this is used for inputting an instruction of displaying a telop (see FIG. **17**, FIG. **18**).

A button image **572** is provided for returning to the search result screen **350** shown in FIG. **12** and the narrowing-down result screen not shown. Furthermore, a button image **574** is provided for displaying an album. When the button image **574** is turned on, images (flowers) imaged by the user are displayed on the stereoscopic LCD **12** in an album form although illustration is omitted.

For example, when the button image **566** is turned on to select displaying of a rotating image, the pictorial book screen **550** as shown in FIG. **17** is displayed. The pictorial book screen **550** shown in FIG. **17** is the same as the pictorial book screen **550** shown in FIG. **16** except for that the display content of the display region **568** is different, and therefore, a redundant description is omitted.

As shown in FIG. **17**, on the pictorial book screen **550**, the display region **568** is brought into association with the button image **566**, in which a rotation button image **580** and the button image **570** are displayed. The rotation button image **580** includes button images **580a**, **580b**, **580c**. When the button image **580a** or **580b** is turned on, or a sliding operation is performed on the button image **580c**, the stereoscopic image of the flower displayed in the display region **554** of the upper screen **550a** is rotated in response thereto. The stereoscopic image of the flower is rotated horizontally, for example.

In FIG. **18**, the pictorial book screen **550** when the stereoscopic image of the flower is rotated about 180 degrees is displayed. Although illustration is omitted, for example, a stereoscopic image for each predetermined angle (one degree in this embodiment) is prepared, and therefore, by designating an arbitrary angle, the stereoscopic image of the flower can be viewed. This makes it possible to see the flower from various angles and easily determine whether or not the flower selected from the search result and the narrowing-down result is the same as the imaged flower.

Furthermore, the actual flower and the stereoscopic image can be compared, capable of more enjoying the search result.

Up to this point, an overview of the operations by using each screen when the flower-examination-with-camera mode is executed is described, and a detailed description for obtaining the search result is made below. In the software of the application of this embodiment, a database for search for searching for a flower the same as the imaged flower is provided. The overview of the data for search included in the database for search is shown in FIG. 19. Here, the data for search is created as to all the flowers contained in the application (electronic pictorial book) of this embodiment.

As shown in FIG. 19, the data for search is assigned identification information (ID). Furthermore, the data for search roughly includes a name of the flower, color information, shape information, condition information and image information. The name of the flower is the name of the flower and described by the text data. The color information is histogram data. In this embodiment, as shown in FIG. 20(A), by using a cut-out image 600 obtained by cutting only the portion of the flower from the photograph of the flower for search (for verification), the color information of the flower for search is obtained, and from the obtained color information, a histogram is calculated. As shown in FIG. 20(B), two circles 610, 612 having different radiuses from the center of the cut-out image 600 are decided. Thus, as shown in FIG. 20(C), one cut-out image is divided into two areas (area A, area B). Here, in FIG. 20(C), for the sake of clarity, the image of the flower is omitted. Also, the sizes of the circle 610 and the circle 612 are fixed. In addition, the position (starting position) from which a line segment 614 starts to rotate is fixed.

As shown in FIG. 20(C), color information (R, G, B) in a case that the line segment 614 connecting the center point of the circles 610, 612 and a certain point on the circumference of the circle 610 is rotated about the center point by a predetermined angle is detected along the line segment at this time for each area A and area B. A histogram in which the color information every predetermined angle in a case that the line segment 614 is fully rotated is represented by numerical values is generated. Here, the histogram is generated for each component (R, G, B) of the color information for each area A and area B.

The shape information is the number of short petals, the number of long petals, a peripheral length of the flower, an area of the flower, complexity of the shape of the flower, a width of the rectangle circumscribed about the outline of the flower, a height of the rectangle circumscribed about the outline of the flower, a shape category and a judgment flag. Here, the shape category is used for filtering the data for search included in the database for search. Also, the number of short petals, the number of long petals, the area of the flower and the complexity of the shape of the flower are used to obtain the similarity level of the shape.

Before converting the information into numerical values, an outline of the flower is first detected from the binarized image of the flower. Then, the center of gravity of the flower is calculated. Next, as shown in FIG. 21(A), from the coordinates (point) of the calculated center of gravity G, an arbitrary point on the outline 700 is decided as a starting point, and a distance T (the number of dots) from the starting point to each of all the points on the outline is measured clockwise (counterclockwise may be possible) in order.

Then, a graph (shape graph) is created, on which the longitudinal axis represents distance T, and the horizontal axis represents an order in which the distance T is measured.

As described by using FIG. 21(A), the shape graph as a result of measuring the distance T is shown in FIG. 21(B). In FIG. 21(B), a cross mark is applied to boundary ups and downs. Here, black crosses means peaks, and white crosses means troughs.

By using the shape graph, numerical values of the above-described information are calculated. This is briefly described below.

The number of short petals is obtained by counting only the number of small peaks from the shape graph. In this embodiment, the small peak means a peak being 6% of the image size. Here, the size of the peak is the distance T at the position to which a black cross is applied. The image size is here a total number of dots of the cut-out image 600, and is set to the same value as to all the flowers. This holds true below.

Similarly, the number of long petals is obtained by counting only the number of large peaks from the shape graph. In this embodiment, the large peak means a peak being 6% or more of the image size.

The peripheral length of the flower is the number of dots (the number of pixels on the outline) on the detected outline. The area of the flower is a total number of dots (the number of pixels) within the outline including the dots on the outline. The complexity of the shape of the flower is a numerical value calculated by dividing the peripheral length of the flower by the area of the flower.

The width of the rectangle circumscribed about the outline of the flower is the number of dots (the number of pixels) corresponding to the width of a rectangle 710 in a case that the rectangle 710 circumscribed about the outline of the flower (object) is obtained as shown in FIG. 21(C). Similarly, the height of the rectangle circumscribed about the outline of the flower is the number of dots (the number of pixels) corresponding to the height of the rectangle 710 in a case that the rectangle 710 circumscribed about the outline of the flower (object) is obtained as shown in FIG. 21(C)).

The shape category is classification about the shape of flowers and petals. In this embodiment, they are classified according to the three judgment methods (judgment of the shape of the flower, judgment of the complexity of the flower, and judgment of the shape of the petals). Each judgment method is described below. The judgment result corresponds to the shape category.

(1) Judgment of the Shape of the Flower

The shape category is judged in the following manner. In a case that the difference between the height and the width of the rectangle circumscribed about the object is equal to or more than 30%, and if the height is larger, a "vertically long flower" is judged, and if the width is larger, a "horizontally long flower" is judged. Furthermore, in a case that the difference between the height and the width of the rectangle circumscribed about the object falls between 20% to 10%, and if the area of the object is less than 40% of the rectangle circumscribed about the object, a "narrow flower" is judged, and if the area of the object is equal to or more than 40% of the rectangle circumscribed about the object, a "flower of a uniform shape in length and width" is judged. In addition, in a case that the difference between the height and the width of the rectangle circumscribed about the object is less than 10%, a "flower of a uniform shape in length and width" is judged.

(2) Judgment of the Complexity of the Flower

The complexity of the flower is judged in the following manner. If the complexity of the flower calculated as described above is less than a first threshold value, "not being complex" is judged. Alternatively, if the complexity of

the flower is equal to or more than a second threshold value being larger than the first threshold value, "being very complex" is judged. And, if the complexity of the flower is equal to or more than the first threshold value and less than the second threshold value, "being complex" is judged.

(3) Judgment of the Shape of the Petal

The shape of the petal is judged in the following manner. It is determined whether or not the shape of the flower is zigzagged. In a case that there are 11 petals or more irrespective of the sizes of them, "being zigzag" is judged. Here, the judgment is performed on only the flower for which the shape of the flower is the "flower of uniform shape". Furthermore, it is judged whether or not longer petals and shorter petals are equal in number. Here, the judgment is performed on only the flower for which the shape of the flower is the "flower of uniform shape". In addition, it is judged whether or not the flower is round-shaped. For example, in a case that the number of peaks is equal to or less than 2 in the shape graph, a round-shaped, that is, round or oval flower is judged.

The judgment flag is a flag for judging whether or not the outline is accurately defined, and turning on (establishment) or off (non-establishment) the flag is described by numerical values of 1 or 0. In a case that the outline is accurately defined, the judgment flag is turned on, and is described by "1". On the other hand, in a case that the outline is not accurately defined, the judgment flag is turned off, and is described by "0".

However, in a case that any one of three conditions shown below is satisfied, it is judged that the outline is not accurately taken. That is, if no three conditions are satisfied, it is judged that the outline is accurately taken.

(1) The outline of the flower (object) is apart from the center of the image. More specifically, at the center of the cut-out image **600**, a circle being 3% of the image size is arranged, and in a case that the circle is not included within the outline, it is judged that the condition (1) is satisfied.

(2) The area of the outline of the flower (object) is extremely small. More specifically, in a case that the area of the outline is equal to or less than 3% of the image size, it is judged that the condition (2) is satisfied.

(3) The center of gravity of the outline of the flower (object) is out of the outline. More specifically, in a case that the center of gravity G is out of the outline, it is judged that the condition (3) is satisfied.

Returning to FIG. **19**, the condition information corresponds to a size of the flower, a time of bloom, the degree of encounter, how flowers bloom, a shape of the flower, kinds, a direction of the flower, and a height of the plant, etc.

The size of the flower is the length of the diameter of the circle circumscribed about a flower, and is described by an average length. The time of bloom is a period (days and months) when a flower blooms, and described by the first and the last days and months of the period. The degree of encounter is a large and small of the frequency of encountering a flower, for example, and the degree of encounter is set to be high as to the flowers which have generally been well known and can be seen nationally. On the other hand, as to the flowers which have not generally been known and can be seen in some regions, the degree of encounter is set to be low. Here, the degree of encounter is set to be medium as to the flowers except for the above description.

How flowers bloom is information about how flowers bloom, and is described by "thinness", "thickness", "long clusters", and "others" in this embodiment. The "thinness" corresponds to a flower which blooms singly, or flowers bloom separately. The "thickness" corresponds not to a

flower which blooms singly, but to a plurality of flowers which bloom in a relatively narrow range and heavily dense on the stem. The "long clusters" corresponds not to a flower which blooms singly, but to flowers which bloom in long clusters. The "others" correspond to flowers which do not correspond to the "thinness", the "thickness", and the "long clusters".

The shape of the flower is information indicating the external shape of a single flower, and described by "the number of petals (3 petals, 4 petals, 5 petals, 6 petals, many)", an "apparent shape of a petal (trumpet-shaped or bell-shaped, not circle)", and "others" in this embodiment. "The number of petals" and the "apparent shape of a petal" are as illustrated, and it is thought that no description is made. The "others" are flowers which do not classified under the conditions, such as "the number of petals" and the "apparent shape of a flower" as described above.

As kinds, any one of "grass flower", "tree flower", and "climbing plant" is described. The direction of the flower is described by any one of "upward direction", "downward direction", and "others" as kinds. Here, "others" is flowers which do not correspond to the "upward direction" and the "downward direction". The height of the plant is the height of the grass in a case of the grass flower, and is described by an average value. Accordingly, in a case of flowers (plants) other than the grass flower, the field of the height of the plant is left blank.

It should be noted that although the detailed description is omitted, the color of the flower, the silhouette, the environment, the region, etc. are described as other condition information.

The image information is image data about reduced images of respective flowers. In this embodiment, reduced images are prepared in advance so as to be included in the data for search, but from images to be displayed in the electronic pictorial book, the thumbnail images may be generated.

Thus, the data for search includes various pieces of information, and is utilized when the flower included in the imaged image is searched. Here, processing of searching (examining) for the flower included in the imaged image is described.

First, a flower as a search target is imaged by using the outward cameras **18b** and **18c** to thereby obtain imaged image data corresponding to respective imaged images. Next, similar to a case of creating the data for search as described above, from the imaged image data, the color information of the imaged flower is obtained to thereby generate a histogram. Here, the two imaged images are acquired from the outward cameras **18b** and **18c**, but by using one of the imaged images, the histogram is generated. Also, a portion enclosed by the round frame of the designation image **154a** from the imaged image is divided into two areas A and B as shown in FIG. **20(B)** and FIG. **20(C)**. Here, the round frame of the designation image **154a** corresponds to the circle **610** shown in FIG. **20(B)** and FIG. **20(C)**.

Next, the shape information of the imaged flower is created in the method the same as that of creating the data for search. First, the imaged image is binalized, and by using the binalized imaged image, the outline (edge) of the flower is extracted.

When the outline is extracted, the distance T between each dot on the outline and the center of gravity G of the image of the flower is sequentially measured to thereby generate a shape graph as shown in FIG. **21(B)**. On the basis of the shape graph, shape information (amount of feature of the

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shape) is obtained as described above. Here, the shape information is the number of short petals, the number of long petals, the peripheral length of the flower, the area of the flower, the complexity of the shape of the flower, the width of the rectangle circumscribed about the outline of the flower, the height of the rectangle circumscribed about the outline of the flower, the shape category and the judgment flag.

Next, on the basis of the imaged image, the size of the flower (the diameter of the circle circumscribed about the flower) is calculated. In this embodiment, from the parallax of the outward cameras **18b**, **18c**, the distance from the outward cameras **18b** and **18c** to the object (flower) is calculated by triangulation. As explained simply, in this embodiment, color information (RGB values) at the center of the imaged image by the outward camera (right camera) **18c** is obtained. Next, the difference between the obtained color information and the color information in each pixel imaged by the outward camera (left camera) **18b** is horizontally searched for each dot from the center to the right end. As a result, the area with less difference is regarded as a matching candidate. Here, if the difference with the matching candidate is large, processing is performed by regarding the object as being at close range from the outward cameras **18b**, **18c** (game apparatus **10**). On the other hand, if the difference with the matching candidate is small, the number of dots (the number of displaced dots) from the center of the imaged image by the outward camera (left camera) **18b** to the area of the matching candidate is obtained.

Next, from the obtained number of displaced dots, an angle (first angle) of the object when seen from the outward camera (left camera) **18b** is calculated. In this embodiment, because it is assumed that the outward camera (right camera) **18c** vertically captures the object, an angle (second angle) from outward camera (right camera) **18c** to the object is regarded as 90 degrees. From the positional relationship (placement distance) between the first angle and the second angle, and the outward camera **18b** and the outward camera **18c**, the distance to the object is obtained by triangulation.

Then, from the distance to the object and the angle of view of the outward cameras **18b**, **18c**, the size of the imaged flower is obtained. The size is calculated as $\text{distance} \times \tan(\text{horizontal angle of view})$. Here, this embodiment assumes that the object (flower) is imaged by aligning on the round frame represented by the designation image **154a**.

Although the detailed description is omitted, in a case that it is determined that the object is at close range, imaging again may be prompted, or the size of the flower when imaging at close range is obtained in advance, and the size may be estimated as a size of the flower.

When the histogram of the imaged flower, the shape information and the size are obtained, filtering the data for search included in the database for search is performed. This is because that if processing of calculating scores, etc. described later is performed on all the data for search, a high processing load is imposed, resulting in a waste of time. In this embodiment, by paying attention to the shape category included in the shape information, the data for search of the shape category different from the shape category of the imaged flower is excluded from the search target. That is, only the data for search being the same in the shape category is used.

After completion of filtering the data for search, the histogram of the imaged flower, the shape information and the size are checked against all the data for search to be used to thereby evaluate the degree of approximation of the color,

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the degree of matching of the shape and the degree of matching of the size. In this embodiment, as the degree of approximation and the degree of matching are high, a high score is added, and as the degree of approximation and the degree of matching are low, a low score is added. Although the detailed description is omitted, scores as to the degree of approximation of the histogram, the degree of matching of the shape and the degree of matching of the size are decided between 0 and 1. Here, in a case that any one of the scores is stressed (the degree of approximation or the degree of matching), weighting may be performed.

For example, the score as to the degree of approximation of the color is calculated, and a list (similarity level list) in which flowers indicated by the data for search are arranged in the descending order of the score is generated. In the similarity level list, the score indicating the degree of approximation of the color is described in correspondence with each name of the flower or each ID, and these flowers are arranged in the descending order of the score. Here, the flowers with the same scores are arranged at random.

Next, the score of the degree of matching of the shape is calculated and added. The degree of matching of the shape is calculated on the basis of the difference between the number of long petals, the difference between the number of short petals, the difference between the complexities and the difference between the areas. As to each of the items, the score is calculated between 0 and 1, and each score is divided by 4. Here, if the number of long petals and the number of short petals are more than those of the object (imaged flower), the score is set to 0. Furthermore, as to each item, as the degree of matching is high, the score is set to be high, and as the degree of matching is low, the score is set to be low.

In addition, the score of the degree of matching of the size of the flower is calculated and added. The score of the size of the flower is also set between 0 and 1. As the degree of matching of the size of the flower is large, the score is set to be high, and as the degree of matching is low, the score is set to be low.

Also, in this embodiment, if a calendar matches the time of bloom, the score is added by one, and if not, the score is not added. More specifically, it is determined whether or not the day and time indicated by a calendar set to the game apparatus **10** is within the time of bloom included in the condition information of the data for search.

Although the detailed description is omitted, in the game apparatus **10**, the calendar is set to the microcomputer **56**, and the calendar is updated on the basis of the time information counted by the RTC **56a**. Accordingly, the calendar managed by the microcomputer **56** is referred.

In addition, the score of the degree of encounter is added. The degree of encounter is set to be high, low, and middle as described, and in a case of being high, the score is added by 1, in a case of being middle, the score is added by 0.5, and in a case of being low, the score is not added.

When the scores of the degree of matching of the shape, the degree of matching of the size of the flower, the degree of matching of the time of bloom and the degree of encounter are thus added, the similarity level list is rearranged in the descending order of the scores.

In this embodiment, the user is next made to select the first to third conditions (how flowers bloom, shape of the flower, kind, in this embodiment), which narrows down the candidates included in the similarity level list, to thereby obtain the search result. This is because that the candidates are too many by merely filtering with the shape category.

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In addition, in a case that the user sets a narrowing-down condition, only the candidates which satisfy the narrowing-down condition are extracted from the candidates of the search result.

FIG. 22 shows one example of a memory map **800** of the main memory **50** shown in FIG. 4. As shown in FIG. 22, the main memory **50** includes a program memory area **802** and a data memory area **804**. In the program memory area **802**, an information processing program, that is, a program of the application of this embodiment is stored. The information processing program is made up of a main processing program **802a**, an imaging program **802b**, a color information generating program **802c**, a shape information generating program **802d**, a score calculating program **802e**, a list generating program **802f**, a search result displaying program **802g**, a narrowing-down program **802h**, a detailed information displaying program **802i**, etc.

The main processing program **802a** is a program for processing a main routine of the application of this embodiment. The imaging program **802b** is a program for imaging a 2D image or a 3D image by using the cameras **18a-18c**. The color information generating program **802c** is a program for acquiring color information (RGB) from the imaged image and generating a histogram from the acquired color information.

The shape information generating program **802d** is a program for creating a shape graph from the imaged image and generating shape information (the number of short petals, the number of long petals, the peripheral length of the flower, the area of the flower, the complexity of the shape of the flower, the width of the rectangle circumscribed about the outline of the flower, the height of the rectangle circumscribed about the outline of the flower, the shape category and the judgment flag).

The score calculating program **802e** is a program for calculating a score indicating the similarity level with each data for search to be used by using the histogram, the shape information and the size as to the imaged image (imaged flower). The list generating program **802f** is a program for creating a list in which candidate flowers are arranged in the descending order of the scores by using the score indicating the similarity level calculated according to the score calculating program **802e** and the scores of the degree of matching of the time of bloom and the degree of encounter.

The search result displaying program **802g** is a program for extracting candidates which match the first to third conditions from the similarity list and displaying them as a search result. The narrowing-down program **802h** is a program for narrowing down the candidates from the search result to the candidates which match the narrowing down condition selected by the user. The detailed information displaying program **802i** is a program for displaying the still image, the explanation, the rotating image, etc. as to the candidate flower (reduced image) selected by the user by using pictorial book data **804b** described later.

Although the illustration is omitted, in the program memory area **802**, a program for backing up various data, a program for outputting sound (sound effect, BGM), etc. are also stored.

In the data memory area **804**, a database for search **804a**, pictorial book data **804b**, imaged image data **804c**, color information data **804d**, shape information data **804e**, size data **804f**, condition data **804g**, similarity list data **804h** and rotating angle data **804i** are stored.

The database for search **804a** is a database of the data for search as to all the flowers contained in the electronic pictorial book (pictorial book data **804b**). The pictorial book

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data **804b** is data as to the electronic pictorial book. More specifically, as shown in FIG. 23, the pictorial book data **804b** includes detailed information data **850**, **852**, . . . of each flower. The detailed information data **850** includes name (ID) data **850a**, caption data **850b**, explanation data **850c**, still image data **850d** and rotating image data **850e**.

The name (ID) data **850a** is data as to a name (ID) of the flower. The caption data **850b** is data of textual information as to the kind of the flower (family name, generic name) and the country of origin, and used for displaying telops. The explanation data **850c** is data of the still image and the explanation sentence of the flower. The still image data **850d** is still image data of the flower, and this still image is a three-dimensional image. The rotating image data **850e** is rotating image data of the flower, and the rotating image is an 3D image in a case that the still image is rotated horizontally by a predetermined angle (by one degree through 360 degrees, for example).

Returning to FIG. 22, the imaged image data **804c** is data as to an image imaged by each of the outward cameras **18b**, **18c**. The color information data **804d** is histogram data generated according to the above-described color information program **802c**.

The shape information data **804e** is data as to the shape information (the number of short petals, the number of long petals, the peripheral length of the flower, the area of the flower, the complexity of the shape of the flower, the width of the rectangle circumscribed about the outline of the flower, the height of the rectangle circumscribed about the outline of the flower, the shape category and the judgment flag) generated according to the shape information generating program **802d**. The size data **804f** is data as to the size of the imaged flower.

The condition data **804g** is data as to the first to third conditions and the narrowing-down condition. The similarity list data **804h** is data of the similarity list generated according to the list generating program **802f** and then narrowed down by the narrowing-down program **802h**. The rotating angle data **804i** is data as to a rotating angle in a case that the rotating image is displayed.

Although illustration is omitted, in the data memory area **804**, other data necessary for execution of the application (information processing) of this embodiment is stored, and flags and counters (timers) necessary for the execution are provided.

FIG. 24-FIG. 29 is a flowchart showing processing (flower examining processing) by the CPU **44a** in order to execute the above-described flower-examination-with-camera mode. As described above, when the button image **104** is turned on on the title screen **100**, the flower examining processing is started as shown in FIG. 24, and imaging processing is executed in a step S1. Here, the CPU **44a** displays the imaging screen **150** shown in FIG. 8 on the stereoscopic LCD **12** and the lower LCD **14** and displays a through image captured by the outward cameras **18b**, **18c** on the display region **154**. Then, according to an imaging instruction by the user, the imaged image data **804c** corresponding to the imaged images (3D images) by the outward cameras **18b**, **18c** is stored in the data memory area **804**.

In a next step S3, the color information of the imaged flower is generated. That is, as described above, the histogram data as to the area A and the area B is generated. Successively, in a step S5, the shape information of the imaged flower is generated. That is, as described above, the data as to the number of short petals, the number of long petals, the peripheral length of the flower, the area of the flower, the complexity of the shape of the flower, the width

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of the rectangle circumscribed about the outline of the flower, the height of the rectangle circumscribed about the outline of the flower, the shape category and the judgment flag is generated.

In a succeeding step S7, the distance to the object (flower) is calculated from the parallax between the L camera (outward camera 18b) and the R camera (outward camera 18c). Then, in a step S9, the size of the imaged flower is calculated. In a next step S11, the data for search is filtered on the basis of the shape category. Accordingly, the data for search different in the shape category is excluded from the object to be used in the search processing to thereby decrease the number of data for search to be used in the search processing.

In a step S13, scores as to candidates are calculated according to the generated color information, and in a step S15, the similarity list in which candidates are arranged in the descending order of the score is generated. Next, in a step S17, a score of the degree of matching depending on the generated shape information is added, and in a step S19, a score of the degree of matching depending on the size of the flower is added. In addition, in a step S21, a score of the degree of matching between the calendar of the apparatus and the time of bloom is added, and in a step S23, a score of the degree of encounter is added.

As shown in FIG. 25, in a next step S25, the similarity list is rearranged in the descending order of the score. In a next step S27, the first condition input screen as shown in FIG. 9 is displayed. In a next step S29, it is determined whether or not the first condition is input. Here, the CPU 44a determines whether or not the button image 234 is turned on in a state that any one of the button images 222-230 is turned on.

If "NO" in the step S29, that is, if the first condition is not input, the process returns to the same step S29. Although illustration is omitted, if the button image 232 is turned on, the process returns to the step S1 shown in FIG. 24 to image again. At this time, the imaged image data 804c, the color information data 804d, the shape information data 804e, the size data 804f, the condition data 804g, and the similarity list data 804h are cleared. This holds true for a case that imaging again is selected below.

On the other hand, if "YES" in the step S29, that is, if the first condition is input, the first condition is stored in a step S31. That is, the condition data 804g is updated. In a succeeding step S33, the second condition input screen 250 as shown in FIG. 10 is displayed. In a next step S35, it is determined whether or not the second condition is input. Here, the CPU 44a determines whether or not the button image 292 is turned on in a state that any one of the button images 272-288 is turned on.

If "NO" in the step S35, that is, if the second condition is not input, the process returns to the step S35 as it is. Although illustration is omitted, if the button image 290 is turned on, the process returns to the step S27. On the other hand, if "YES" in the step S35, that is, if the second condition is input, the second condition is stored in a step S37. That is, the condition data 804g is updated. In a next step S39, the third condition input screen 300 as shown in FIG. 11 is displayed. Successively, in a step S41, it is determined whether or not the third condition is input. Here, the CPU 44a determines whether or not the button image 332 is turned on in a state that any one of the button images 322-328 is turned on.

If "NO" in the step S41, that is, if the third condition is not input, the process returns to the step S41 as it is. Although illustration is omitted, if the button image 330 is turned on,

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the process returns to the step S33. On the other hand, if "YES" in the step S41, the third condition is stored. That is, the condition data 804g is updated. Then, in a step S45, the candidates are filtered based on the conditions. That is, the CPU 44a deletes the candidates which do not match the first to third conditions from the similarity list.

As shown in FIG. 26, in a next step S47, the search result screen 350 as shown in FIG. 12 is displayed. In a succeeding step S49, it is determined whether or not the candidates have to be narrowed down. That is, the CPU 44a determines whether or not the button image 372 is turned on.

If "NO" in the step S49, that is, if the candidates are not narrowed down, it is determined whether or not a flower is selected in a step S51. Here, the CPU 44a determines whether or not the button image 380 is turned on in a state that any one of the reduced images displayed in the display region 374 is turned on. If "NO" in the step S51, that is, if a flower is not selected, the process returns to the step S49. On the other hand, if "YES" in the step S51, that is, if a flower is selected, the process proceeds to a step S73 shown in FIG. 27.

On the other hand, if "YES" in the step S49, that is, if the candidates are narrowed down, the narrowing-down condition selecting screen 400 as shown in FIG. 13 is displayed in a step S53. In a next step S55, it is determined whether or not narrowing-down condition is selected. Here, the CPU 44a determines whether or not any one of the button images displayed in the display region 424 is turned on.

If "NO" in the step S55, that is, if no button image displayed in the display region 424 is turned on, it is determined whether or not the result is to be seen in a step S57. That is, the CPU 44a determines whether or not the button image 428 is turned on. If "NO" in the step S57, that is, if the result is not to be seen, the process returns to the step S55 as it is. Although illustration is omitted, if the button image 426 is turned on, imaging again is determined, and the process returns to the step S1. On the other hand, if "YES" in the step S57, that is, if the result is to be seen, the process proceeds to a step S69 shown in FIG. 27.

On the other hand, if "YES" in the step S55, that is, if there is a selection of the narrowing-down condition, the narrowing-down condition setting screen (450, 500) according to the narrowing-down condition as shown in FIG. 14 or FIG. 15 is displayed in a step S59. In a succeeding step S61, only the flowers which match the narrowing-down condition are displayed. That is, in the display region 458 and 508, reduced images as to the candidates (flowers) which are narrowed down according to the narrowing-down condition are displayed.

Then, in a step S63, it is determined whether or not the narrowing-down condition is decided. For example, the CPU 44a determines whether or not the button image 480 is turned on in a state that the height of the plant is selected on the narrowing-down condition setting screen 450 in FIG. 14. Furthermore, the CPU 44a determines whether or not the button image 530 is turned on in a state that any one of the button images 522-526 is turned on on the narrowing-down condition setting screen 500 in FIG. 15.

If "YES" in the step S63, that is, if the narrowing-down condition is decided, the narrowing-down condition is set in a step S65, that is, the condition data 804g is updated, and the process returns to the step S53. On the other hand, if "NO" in the step S63, that is, if the narrowing-down condition is not decided, it is determined whether a skip or not in a step S67. For example, the CPU 44a determines whether or not the button image 478 is turned on on the narrowing-down condition setting screen 450 in FIG. 14.

Furthermore, the CPU 44a determines whether or not the button image 530 is turned on in a state that the button image 528 is turned on on the narrowing-down condition setting screen 500 in FIG. 15.

If "NO" in the step S67, that is, if the narrowing-down condition and the skip are not decided, the process returns to the step S63. On the other hand, if "YES" in the step S67, that is, if the skip is performed, the process returns to the step S53.

As shown in FIG. 27, in the step S69, a narrowing-down result (narrowing-down result screen) is displayed. That is, the candidates which do not match the narrowing-down condition are excluded from the search result. In a succeeding step S71, it is determined whether or not a flower is selected. Here, the CPU 44a determines whether or not a reduced image of the candidate flower is selected on the narrowing-down result screen. If "NO" in the step S71, that is, if a flower is not selected, the process returns to the step S71 as it is. On the other hand, if "YES" in the step S71, that is, if a flower is selected, the pictorial book screen of the selected flower is displayed in the step S73. Here, the pictorial book screen 550 as shown in FIG. 16 is displayed in order to display the detailed information of the selected flower.

In a succeeding step S75, it is determined whether or not an explanation is to be seen. Here, the CPU 44a determines whether or not the button image 564 is turned on. This holds true below. If "YES" in the step S75, that is, if the explanation is to be seen, the process proceeds to a step S81 shown in FIG. 28. On the other hand, if "NO" in the step S75, that is, if an explanation is not to be seen, it is determined whether or not a rotating image is to be seen in a step S77. Here, the CPU 44a determines whether or not the button image 566 is turned on. This holds true below.

If "YES" in the step S77, that is, if a rotating image is to be seen, the process proceeds to a step S89 shown in FIG. 29. On the other hand, if "NO" in the step S77, that is, if a rotating image is not to be seen, it is determined whether to be ended or not in a step S79. Although the detailed description is omitted, an end instruction is input by the user. This holds true below. If "NO" in the step S79, that is, if not to be ended, the process returns to the step S75. On the other hand, if "YES" in the step S79, that is, if to be ended, the flower examining processing is ended.

Although illustration is omitted, in a step S81 shown in FIG. 28, a pictorial book screen 550 on which the explanation is shown is displayed. In a succeeding step S83, it is determined whether or not a still image is to be seen. Here, the CPU 44a determines whether or not the button image 562 is turned on. This holds true below. If "YES" in the step S83, that is, if a still image is to be seen, the process returns to the step S73 shown in FIG. 27. On the other hand, if "NO" in the step S83, that is, if a still image is not to be seen, it is determined whether or not a rotating image is to be seen in a step S85.

If "YES" in the step S85, the process proceeds to the step S89 in FIG. 29. On the other hand, if "NO" in the step S85, it is determined whether or not to be ended or not in a step S87. If "NO" in the step S87, the process returns to the step S83 as it is. On the other hand, if "YES" in the step S87, the flower examining processing is ended.

As shown in FIG. 29, in the step S89, the pictorial book screen 550 as shown in FIG. 17 is displayed. Here, the rotating image is displayed on the display region 554 of the upper screen 550a. In a next step S91, it is determined whether or not there is an instruction for rotation. That is, the CPU 44a always detects the operation data to thereby

determine whether or not the rotation button image 580 is operated, and stores (overwrites) the rotating angle data 804i corresponding to the rotation angle in the data memory area 804.

If "YES" in the step S91, that is, if there is an instruction for rotation, the image of the flower is rotated and displayed in accordance with an operation in a step S93, and the process returns to the step S91. In the step S93, the CPU 44a displays a stereoscopic image stored in correspondence with the rotation angle indicated by the rotating angle data 804i in the display region 554.

On the other hand, if "NO" in the step S91, that is, if there is no instruction for rotation, it is determined whether or not the still image is to be seen in a step S95. If "YES" in the step S95, the process returns to the step S73 shown in FIG. 27. On the other hand, if "NO" in the step S95, it is determined whether or not an explanation is to be seen in a step S97. If "YES" in the step S97, the process returns to the step S81 shown in FIG. 28. On the other hand, if "NO" in the step S97, it is determined whether to be ended or not in a step S99. If "NO" in the step S99, the process returns to the step S91 as it is. On the other hand, if "YES" in the step S99, that is, if an end, the flower examining processing is ended.

Although the illustration is omitted here, in a case that the button image 570 is turned on on the pictorial book screen 550, the CPU 44a displays or hides the telop. Also, although the illustration is omitted, in a case that the button image 572 is turned on on the pictorial book screen 550, the CPU 44a returns to the search result screen 350 or the narrowing-down result screen which has been displayed immediately before the pictorial book screen 550. Moreover, although the illustration is omitted, in a case that the button image 574 is turned on on the pictorial book screen 550, the CPU 44a makes a transition to a mode in which the images of the flowers imaged by the user are displayed in an album format. At this time, the flower examining processing is ended.

According to this embodiment, the data for search of the category different from the category classified based on the shape of the flower is filtered, and therefore, the number of pieces of data for search as an object to be searched can be reduced. Accordingly, it is possible to prevent the processing load and waste of time from being taken as much as possible.

Furthermore, in this embodiment, information including a stereoscopic image is presented, and therefore, it is possible to present information with high interest. Specifically, the information of the object can be seen with the object imaged, and therefore, it is possible to compare the actual object and the stereoscopic image and more enjoy the search result. Moreover, it is possible to accurately examine the imaged flower.

Also, in this embodiment, the flower is searched as an object, but there is no need of being restricted thereto. For example, natural objects, natural products, and artificial materials, such as insects, fishes, cars, autcycles, sign boards, vegetables, fruits, etc. can be applied.

Additionally, there is no need of being restricted to the configuration of the game apparatus shown in this embodiment. For example, one LCD may be appropriate, or no touch panel may be provided. Alternatively, the touch panel may be provided on the two LCDs.

In addition, this invention can be applied to an information processing system in which respective processing for the information processing may be distributedly executed by a plurality of computers, or the like.

Moreover, in this embodiment, a flower is imaged by the game apparatus, and the candidate is searched to present the

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detailed information of the selected candidate, but there is no need of being restricted thereto. For example, by building a server-client network, the flower examining processing of this embodiment may be executed through communications between the server and the game apparatus. In such a case, the game apparatus images a flower according to an operation by the user, calculates the distance to the object (flower) on the basis of the imaged image, makes the user further set the first to third conditions, and transmits the imaged image, the distance to the object and the first to third conditions to the server via a network. In response thereto, the server creates a similarity level list, obtains the search result, and transmits the search result to the game apparatus. In addition, when the game apparatus sets the narrowing-down condition based on the search result, it transmits the narrowing-down condition to the server. Accordingly, the server extracts candidates which match the narrowing-down condition from the search result, and transmits the result which is narrowed down to the game apparatus. Then, the game apparatus notifies a selected candidate to the server. In response thereto, the server transmits the detailed information of the notified candidate to the game apparatus. Thus, the game apparatus presents the detailed information to the user.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

What is claimed is:

1. An information processing apparatus, comprising:

a displayer configured to provide a stereoscopic display; a plurality of imagers which are provided to be flush with each other;

a judger configured to judge a size of an object based upon images of the object obtained by at least two of said plurality of imagers, wherein the judger includes a distance calculator, configured to detect a parallax between two images obtained from at least two imagers of the plurality of imagers and to calculate a distance to the object based upon parallax and a set distance between the two imagers, and a size calculator which calculates the size of the object based upon a calculated distance to the object and an angle of view of the imagers;

a reducer configured to reduce the number of a plurality of search targets which are previously contained by the processing apparatus, wherein reducing the number of search targets is based upon a shape of said object in said images;

a calculator configured to calculate a similarity level between said object and each of the search targets which are reduced in number by said reducer, the similarity level being calculated based upon a size of the object and a particular characteristic feature of said images;

a selector configured to allow a selection of a predetermined condition as to said object;

a deleter configured to eliminate as candidates said search targets which do not match the predetermined condition;

a candidate presenter configured to determine search targets having a high calculated similarity level as candidates for presentation; and

an information presenter configured to present search target information via the displayer including a stereo-

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scopic image corresponding to a search target selected from determined search targets which are not eliminated as candidates.

2. An information processing apparatus according to claim 1, wherein said feature of the image is color information.

3. An information processing apparatus according to claim 1, wherein said feature of the image is information in relation to a shape of an object.

4. An information processing apparatus according to claim 1, further comprising:

a similarity level increaser configured to increase a calculated similarity level when a degree of encounter of said object is high.

5. A non-transitory storage medium storing an information processing program of an information processing apparatus having a displayer which is configured to provide a stereoscopic display, and a plurality of imagers which are provided to be flush with each other, said information processing program causes a computer of said information processing apparatus to provide functionality comprising:

a judger which judges a size of an object based upon images of the object obtained by at least two of said plurality of imagers, wherein the judger includes a distance calculator, configured to detect a parallax between two images obtained from at least two imagers of the plurality of imagers and to calculate a distance to the object based upon parallax and a set distance between the two imagers, and a size calculator which calculates the size of the object based upon a calculated distance to the object and an angle of view of the imagers;

a reducer which reduces the number of a plurality of search targets which are previously contained by the processing apparatus, wherein reducing the number of search targets is based upon a shape of said object in said images;

a calculator which calculates a similarity level between said object and each of the search targets which are reduced in number by said reducer, the similarity level being calculated based upon a size of the object and a particular characteristic feature of said images;

a selector configured to allow a selection of a predetermined condition as to said object;

a deleter configured to eliminate as candidates said search targets which do not match the predetermined condition;

a candidate presenter which determines search targets having a high calculated similarity level as candidates for presentation; and

an information presenter which presents search target information via the displayer including a stereoscopic image corresponding to a search target selected from determined search targets which are not eliminated as candidates.

6. A computer implemented information presentation method of an information processing equipment arrangement having at least one computer processor, a displayer which is configured to provide a stereoscopic display, and a plurality of imagers which are provided to be flush with each other, said equipment arrangement configured to provide functionality and perform operations comprising:

judging a size of an object based upon images of the object obtained by at least two of said plurality of imagers, wherein said judging includes detecting a parallax between two images obtained from two imagers of the plurality of imagers and calculating a distance

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to the object based upon parallax and a set distance between the two imagers and calculating the size of the object based upon a calculated distance to the object and an angle of view of the imagers;

reducing the number of a plurality of search targets which are previously contained by the computer processor based upon a shape of said object in said images;

calculating a similarity level between said object and each of the search targets which are reduced in number by said reducing operation, the similarity level being calculated based upon a size of the object and a particular characteristic feature of said images;

determining search targets having a high calculated similarity level from the calculating operation as candidates for presentation;

selecting a predetermined condition as to said object;

eliminating as candidates said search targets which do not match the predetermined condition; and

presenting search target information via the displayer including a stereoscopic image corresponding to a search target selected from determined search targets which are not eliminated as candidates.

7. An information processing system, comprising:

a displayer which allows a stereoscopic display;

a plurality of imagers which are provided to be flush with each other; and

one or more computer processors configured to perform operations which provide specific functionality to:

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judge a size of an object based upon images of the object obtained by at least two of said plurality of imagers, wherein judging a size includes detecting a parallax between two images obtained from two imagers of the plurality of imagers and calculating a distance to the object based upon parallax and a set distance between the two imagers and calculating the size of the object based upon a calculated distance to the object and an angle of view of the imagers;

reduce a plurality of search targets which are previously contained by the one or more computer processors, wherein reducing the number of search targets is based upon a shape of said object in said images;

calculate a similarity level between said object and each of the search targets which are reduced in number by said reducer, the similarity level being calculated based upon a size of the object and a particular characteristic feature of said images;

determine search targets having a high calculated similarity level as candidates for presentation;

select a predetermined condition as to said object;

eliminate as candidates said search targets which do not match the predetermined condition; and

present search target information via the displayer including a stereoscopic image corresponding to a search target selected from determined search targets which are not eliminated as candidates.

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